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VIEWS, NEWS AND INTERVIEWS.

In electrical circles several bets have been made on the pronunciation of the word "paresis." Up to date the only man who has won is the man who offered to bet.

A press dispatch from Birmingham, Ala., under recent date, is as follows: "R. D. Burnett, proprietor of two of the largest and finest saloons in the city, has been arrested on three charges in connection with the finding of an electric gambling device in one of his saloons. The police swore out a search warrant, and under the saloon counter they found the device. It consisted of a metal plate inserted under the counter and connected with an electric wire. By the pressing of a button a strong electric current can be turned on. It charges the plate and counter very heavily, and dice loaded with steel in the end, when thrown on the counter, are attracted by the current so strongly as to cause them to fall a fixed way. The device is a very clever trick for the use of loaded dice, and by its operation the man who works it has an airtight cinch. Burnett is charged with keeping a gaming house and devices, with playing at a game of chance, and with permitting gambling in a public place."

The Consolidated Traction Company and the South Orange and Newark Railroad Company have entered into a binding agreement to withdraw all of the free passes in Newark on January 1. After that date even the presidents of these roads will have to pay fare, and the Mayor will have to give up a nickel every time he rides. These two companies have had at least 1,000 free passes out. The deadheads are to be so thoroughly expunged on New Year's day, according to President Ward, of the South Orange line, that if there are any persons in the State whom the law entitles to passes the company will supply them with new five cent pieces, but no more pasteboards will be issued under any circumstances. The only persons who can ride free hereafter are policemen and firemen in uniform. Uncle Sam pays the fare of the letter carriers.

The electrician of the Madison Square Garden, New York, contrived a clever method of scoring during the six-day bicycle race last week. The original system of scoring with numbers and blackboards proved inadequate, and so the electrician fixed up for each rider a pole on which were 10 incandescent lamps. The track was 10 laps to the mile. As each rider completed a lap his scorer would light one lamp, and so on until all 10 were lighted, when upon the completion of a mile the lights were all extinguished, only to be relighted in order again.

"Consular Reports" for December, 1893, has been received, and contains much of interest to manufacturers.

The "Ideal" Direct Connected Engine and Dynamo.

The state of perfection at which the latest types of steam engines have arrived is shown in nothing so clearly as in the increasing demand for automatic types of engines to be direct connected to dynamos. The fluctuations in load, especially in street car service, are so great and so numerous, fluctuations of 25 to 100 per cent. of the entire load occurring almost instantaneously, that it has taxed the inventive genius of our engine builders to the utmost to produce engines that will stand the strain. In the case of belt-driven dynamos, a severe short circuit will usually cause the belt to fly off and thus relieve the engine, but a direct connected engine must not only be able to maintain a uniform speed under these sudden changes of load, but it must not fly to pieces if a short circuit brings the engine to a sudden stand still.

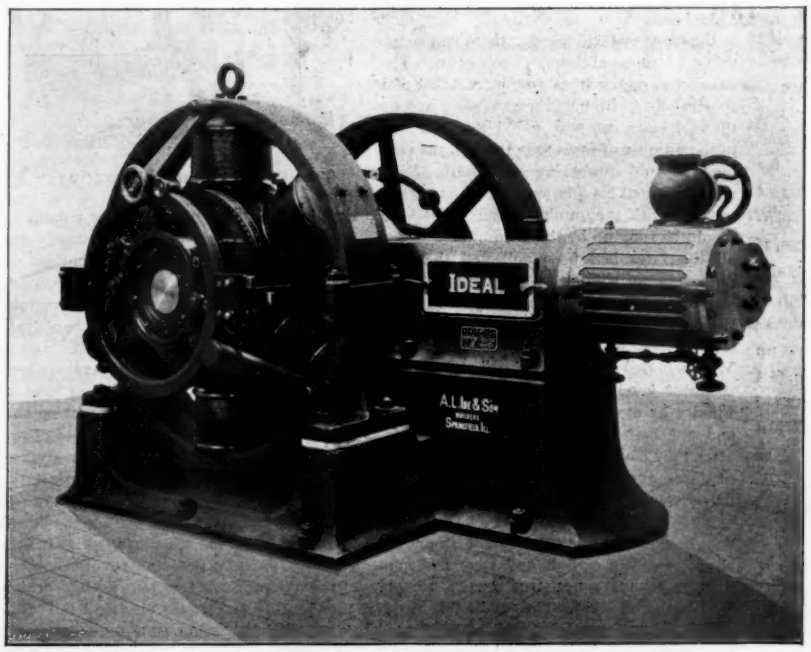
That the day of slow-speed engines with deadly fly wheels is past for electrical work is generally acknowledged. Where space is not very valuable, dynamo sbelted to high-speed engines will continue to be used, but where space becomes a matter for grave consideration, the future demand must be for direct connected engines as soon as engine builders can supply a suitable engine.

To meet this demand, the engine shown in the accompanying illustration has been built by A. L. Ide & Son, of Springfield, Ill. The illustration is taken from one of three Ideal engines recently shipped by this firm for use in lighting the new Southern Hotel, in St. Louis, Mo. Two of these engines had 14x14 cylinders, the third had a 13x12 cylinder. All were regulated to run at 275 revolutions. Each of these engines had a General Electric Company's armature keyed on the crank shaft in place of the plain pulley. The construction of the armature and engine are such that no out-board bearing is required. The two 14x14 engines are to drive dynamos belted from the governor pulleys in addition to the direct connected armatures.

The points of superiority claimed by the builders of these engines for this form are as follows: They claim that they will not vary over one per cent. in speed for a sudden change of 100 per cent. in load. They are perfectly self-contained and balanced. Every engine was adjusted before leaving the works to run at its specified speed under full load, and so balanced as to run without shaking with all anchor bolts removed. Excellence in workmanship and material—steel and bronze entering into its construction to an unusual extent. The engines are provided with the well-known Ideal system of self oiling, which supplies all the working parts with a constant stream of oil that is used over and over again. There is positively no oil scattered in any direction. The armatures are, therefore, entirely free from any danger that could result from a splash of oil.

That these engines are peculiarly adapted to work in places where space is valuable, will be apparent from these dimensions:

The 14x14 engines, with armatures attached complete, as shown in the illustration, can each be placed in a box 68 inches high, 81 inches wide, 10 feet and 3 inches long, and their rated horse power is 125. The 13x12 engine, 100 horse-power, can be placed in a box 68x74x9 feet and 11 inches.



THE "IDEAL" DIRECT CONNECTED ENGINE AND DYNAMO.

THE STREET CAR CONDUCTOR.

A REVIEW OF THE DUTIES AND TRIALS OF THIS HARD-WORKING INDIVIDUAL.

HONESTY OF PRIMARY IMPORTANCE—POLITENESS AN ESSENTIAL ELEMENT—THE "BROTHER-IN-LAW" AND HOW HE HELPS OUT—A GOOD MEMORY NECESSARY—AN AMUSING INCIDENT—STEAM RAILWAY AND STREET CAR CONDUCTORS COMPARED.

The conductor of to-day has comparatively great responsibilities placed upon him. In the first place, he must be, as it were, a traveling treasurer, one whose cash drawer is his pocket and whose account book is the fare register. Being continually with a check upon him, in order to preserve his position, he must be scrupulously careful about his honesty. This, of course, is of first consideration. A conductor who is dishonest, and found out to be so, immediately loses his position and is entered upon the books of the company with a black mark opposite his name. Once detected, he can never secure a position in a locality anywhere near his last one.

The numerous spotters who are employed by the car companies have their uses, but their services are only required to avoid flagrant dishonesty, for it is impossible, unless one be within the car, to tell whether a conductor does or does not do his duty honestly. Along the line these men may be seen getting on or off a car and noticing with sharp eyes the fare register and incidentally the conductor who ignores him entirely, and in case of any wide difference between the number of passengers in the car and the number of fares indicated by the fare register, a report is at once made at the office. There can be little doubt that this surveillance is obnoxious to the conductor, but many companies have found that it is necessary. However, in the very crowded thoroughfares, the companies whose lines run through them feel assured that in the presence of any passengers a conductor would not dare to take the risk of ringing up short a few fares for himself. In the

hurry and rush incidental to daily traffic a conductor's memory is apt to fail him, and he sometimes finds at the end of the line that he is either ahead or behind in his cash account.

Doing a strictly cash business, there are a few complications arising. Numerous devices have been invented by evil minded men, men who thought they could beat the company out of a few dollars, which enabled dishonest conductors to appropriate a few fares to themselves. One of these has been termed, for some unaccountable reason, a "brother-in-law." This little piece of apparatus is a tiny bell concealed in the palm of the conductor's hand, and instead of ringing up his portable fare register, he slyly gives this bell a tap, and unless the passenger is sharp enough to notice that there is no difference in the numbers on the face of the register, the sum of money would go to the credit, or in this case, the discredit of the conductor. Sooner or later, however, these men are found out, and it has now come to be a saying of conductors on all lines, "It don't pay to be dishonest," and with the time worn motto, "Honesty is the best policy," they, among many others, consider that merely as a matter of policy, if not from a moral point of view, honesty pays in the long run.

Conductors can make or mar, to any great extent, the character of a road. We all have experienced the satisfaction of riding in a car with a conductor who is universally polite; and the company inform their conductors that politeness always pays. The man who has in charge the employment of this kind of help for the line has a great responsibility placed upon him. He must keep the men well under his eye and be sure that they are not lax in their duties. On some roads the rules of the company necessitate the conductors ringing up each fare as the passenger enters the car. While this iron-clad rule secures the company, the conductor is ofttimes left with a deficit, for unless he is very quick, when a number of people get in by both front and rear platforms, he is apt to miss one or two fares, if the passengers choose to be dishonest and not tender their fare. Their life is not, as one may be led to suppose, so monotonous; it is not merely collecting and ringing up fares. He must employ considerable tact and judgment; he must treat the crusty old lady and the quarrelsome old man with just as much politeness and consideration as he would the most docile passenger.

Conductors, like many others, are always liable to make mistakes; they may be the cause of many accidents, for example, by ringing the bell for the car to start before the passenger has fairly stepped upon the platform, and thus cause damage to life or limb.

It was said of the elder Rothschild that he used to take pleasure in giving a sovereign to a beggar and watching him run away for fear the mistake might be noticed. In a letter from the Baron to a friend the former says, "If you have never tried this, it would be quite worth your while to do it a few times." This, however, is a pleasure which very few can participate in, but in order to try it on a small scale, the average conductor is a fit subject. Several times have I seen the conductor return more than the required change and beam with pleasure when the passenger returned the excess. To quote the Baron de Rothschild, if such a thing happens to anyone, it is worth his while, merely from the amusement point of view, if not from a sense of justness, to return the amount which does not rightly belong to him.

The conductor must have his little joke, too, and we find him asking, with an expression child-like and bland, when a passenger accompanied by a friend, hands him two nickels, "How many, please?" The passenger is often tempted to answer for four or five, but the humor of the situation strikes him and he, too, realizes that it is one of the few little pleasures the conductor has. His life is full of incidents and he could tell many stories of travel on his limited line.

The salary of a conductor is, in many cases, more than that of the driver, while in cable and trolley cars, the wages are about the same, for the responsibilities are more equally divided.

The duties of a conductor on a railway train and those of a conductor on a street railway are widely different. The former must have a remarkably retentive memory; he must recognize faces at a glance and must remember them for quite a while. He must know at what station they get on and at what station they leave, but their senses are made very acute by continual practice and after a while they find very little trouble to store up in their mind, for a short while, faces of the occupants of three or four passenger coaches. The street railway conductor, however, does not require such a high order of memory, for the time between the entrance of the passenger in the car and the payment of his fare should be of very short duration, the shorter the better.

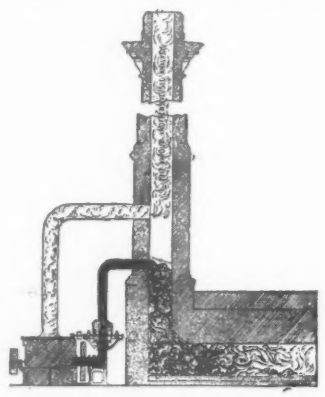
Where a number of passengers enter a car at once, the conductor is apt to become confused and ring up either too few or too many fares. A case happened in Brooklyn this last Summer on a car line running to the base ball grounds. The car was jammed; men stood on the steps and boys had clambered up on the roof. Very soon in the front seats of the car there was something of unusual interest going on. The passengers on the front row were rather of a sporting disposition and were betting among themselves to see who could guess nearest to the number of fares they thought the conductor would appropriate to himself. Each man deposited his quarter in a common pool, together with the number which he guessed would be rung up by the conductor. When all the fares had been collected the conductor began ringing them up as quickly as possible.. When he had reached about half the required number, the man whose guess was nearest to that shouted, "Oh stop." With mingled cries of "go on" and "stop," the poor conductor kept ringing up fares. Finally he stopped in his violent exercise, and one man away up in the front shouted, after they had found out the exact number of fares appropriated, "Oh, I forgot the driver was in this deal."

Much to their credit, however, it may now be said that this condition of affairs has almost entirely ceased, and very few conductors who are not trustworthy remain long in the business. The conductor, too, is a fit subject for a joke, and the illustrated papers, it must be confessed, have treated him rather rudely. Yet withal, he is not a discontented mortal. The Winter treats him roughly, and in the Summer time he has what the small boy enviously declares to be a continuous open air ride. Few, however, envy him; his is not a bed of roses, and to be a successful conductor, the primary requisites are that a man should be a gentleman. Coming in contact, as he does, with the weaker sex, his manner is somewhat softened, and those who often think they have just cause for complaint, from some slight negligence on the part of this much abused individual, should pause a moment before making a complaint, for possibly the conductor may have a number of little mouths at home depending on him for support, and a day out of work means a corresponding amount of deprivation and perhaps suffering.

JULIAN A. MOSES.

The Elliott Smoke Annihilator.

By kind permission of the directors of the Mint, Birmingham, a large party of well-known technical men and press representatives paid a visit to that establishment recently to inspect the working of the smoke annihilator in use there. This invention is the outcome of a series of experiments made by Mr. Samuel Elliott at his works at Newbury. His attention was first directed towards the smoke difficulty by the continued complaints which the local authorities made against the emission of smoke from his chimney. These complaints and the penalties attached to them caused him to take the matter up, and he at last succeeded in making a machine that deals with the smoke difficulty. Two years ago the invention was exhibited on the Thames Embankment, London, and was seen in operation by many of those interested in the question. At that time the machine fulfilled its purpose and was pronounced a success, but it was found that some details connected with the fitting of the apparatus and the detention of the residual products required working out, and these matters have now been accomplished to the satisfaction of experts. It absolutely annihilates the smoke as well as all sulphurous and noxious fumes connected therewith. The machine can be easily attached to chimney shafts, and is simple and inexpensive in its application. It can be placed in any position, either within or without the building, and can be attached either to existing machinery by a belt, or worked by a separate engine of nominal power. When the



THE ELLIOTT SMOKE ANNIHILATOR.

machine is put into operation, the volume of smoke that is being produced instantly disappears, being drawn into the annihilator, where it undergoes a process of washing, leaving only a white vapor to escape into the air, from which all traces of carbon, dust, or sulphur, have been effectually eliminated. By this invention, high chimneys are rendered unnecessary, and the cheapest form of fuel can be burned without incurring any more risk of smoke than by the use of the costliest fuel. The machine can be applied with equal success to all kinds of steam boilers. The residual products recovered from the smoke washings include the liquid that flows from the washings, which makes a most powerful disinfectant; while another of the bye products is a pure carbon, which finds a ready market for electrical and other purposes. For some time, the apparatus inspected has been in constant work at the Mint, Birmingham, affixed to their largest chimney, having 11 furnaces and six muffles, equal to about 25 furnaces. Until this machine was affixed, these furnaces had been the subject of continual complaints. It is evident from the working of the machine on such a large scale that the invention is capable of coping with the smoke question in every form. Our illustration shows the style of the apparatus, from which an idea of its character can be formed.—*London Industries and Iron.*

Lord Kelvin recently unveiled the Joule memorial statue, which has been placed in the Manchester, England, Town Hall as a gift to the city. The statue forms a companion to Chantrey's statue of Dr. Dalton, of whom Joule was, in his early days, a pupil. In an address delivered at the time, Lord Kelvin dealt with the discoveries and experiments of Joule.

Inventions, Researches and Writings of Nikola Tesla.

The above is the title of a new, valuable and interesting book by Thomas Commerford Martin, editor of our esteemed contemporary, the *Electrical Engineer*. The book will be ready for distribution about the first of the new year and will be sent, postage free, on receipt of four dollars by the ELECTRICAL REVIEW, 13 Park Row, New York. It contains an excellent and characteristic portrait of Mr. Tesla, beside nearly 400 illustrations distributed through 500 pages of reading matter. The preface to the work follows:

The electrical problems of the present day lie largely in the economical transmission of power and in the radical improvement of the means and methods of illumination. To many workers and thinkers in the domain of electrical invention, the apparatus and devices that are familiar, appear cumbrous and wasteful, and subject to severe limitations. They believe that the principles of current generation must be changed, the area of current supply be enlarged, and the appliances used by the consumer be at once cheapened and simplified. The brilliant successes of the past justify them in every expectancy of still more generous fruition.

The present volume is a simple record of the pioneer work done in such departments up to date, by Mr. Nikola Tesla, in whom the world has already recognized one of the foremost of modern electrical investigators and inventors. No attempt whatever has been made here to emphasize the importance of his researches and discoveries. Great ideas and real inventions win their own way, determining their own place by intrinsic merit. But with the conviction that Mr. Tesla is blazing a path that electrical development must follow for many years to come, the compiler has endeavored to bring together all that bears the impress of Mr. Tesla's genius, and is worthy of preservation. Aside from its value as showing the scope of his inventions, this volume may be of service as indicating the range of his thought. There is intellectual profit in studying the push and play of a vigorous and original mind.

Although the lively interest of the public in Mr. Tesla's work is perhaps of recent growth, this volume covers the results of full 10 years. It includes his lectures, miscellaneous articles and discussions, and makes note of all his inventions thus far known, particularly those bearing on polyphase motors and the effects obtained with currents of high potential and high frequency. It will be seen that Mr. Tesla has ever pressed forward, barely pausing for an instant to work out in detail the utilizations that have at once been obvious to him of the new principles he has elucidated. Wherever possible his own language has been employed.

It may be added that this volume is issued with Mr. Tesla's sanction and approval, and that permission has been obtained for the re-publication in it of such papers as have been read before various technical societies of this country and Europe. Mr. Tesla has kindly favored the author by looking over the proof sheets of the sections embodying his latest researches. The work has also enjoyed the careful revision of the author's friend and editorial associate, Mr. Joseph Wetzler, through whose hands all the proofs have passed.

Engineering Association of the South.

The Engineering Association of the South met at Nashville, Tenn., December 14, with a fair attendance. Messrs. John M. Picton, George F. Blackie and Charles E. Bowron, were elected to membership. The following officers have been elected for the next year: President, Charles Hermany, Louisville, Ky.; first vice-president, W. C. Smith, Nashville, Tenn.; second vice-president, J. Kruttschnitt, Houston, Tex.; secretary, Hunter McDonald, Nashville, Tenn.; treasurer, W. T. Magruder, Nashville, Tenn. Directors from Tennessee, W. W. Carson, Knoxville; W. L. Dudley and E. C. Lewis, Nashville; from Kentucky, John B. Atkinson, Earlington; from Georgia, George H. Crafts, Atlanta. The Association will meet again on January 9.

More Difficult than Ocean Telephony.

A woman some time ago left 100,000 francs as a prize for the Institute of France, to be given to the first person who, within the next 10 years, communicates with a celestial body and receives an answer. It is possible that the Council of State may decide that it is unable to accept the legacy, in which case it will be offered to the Institute of Milan first, and upon the inability of the latter institution to accept it, it will be offered to other institutes.

Tesla Motors Operated from Single Phase Two Wire Alternating Circuits.

The reader who has followed up the line of work in which Mr. Tesla has been recently engaged will, no doubt, be interested to hear of some results which have been crystallized into two patents recently granted to Mr. Tesla.

As early as 1888 a paper was read before the American Institute of Electrical Engineers, in which Mr. Tesla first publicly described his new multiphase system of operating alternating current motors. As an outgrowth of this, results have been obtained by others working in the same direction, and valuable and interesting have been the observations and practical devices obtained.

In the system above mentioned, each motor is supplied with two or more energizing circuits, through which are passed alternating currents, having in each circuit such a difference of phase, that by their combined or resultant action they produce a rotary progression of the poles or points of maximum magnetic effect of the motor, and thereby maintain the rotation of the armature.

Three wires are necessary in a system of this kind, but in order to avoid this, Mr. Tesla set to work to devise a means whereby the phase motors could be operated from the ordinary single phase alternating circuit by creating a difference of phase locally at and in the motor.

The patents below referred to had this object in view, and it will be noticed that

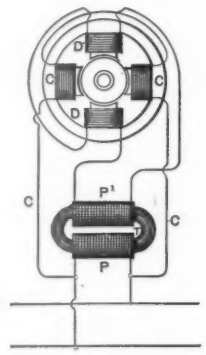


FIG. 1.—TESLA MOTOR WITH TWO ENERGIZING CIRCUITS.

the fundamental idea involved is to pass a single alternating current through both of the energizing circuits of the motor, and to retard the phase of the current in one circuit to a greater or less extent than in the other, either by induction or by derivation, is the distribution of current between the two motor circuits.

The diagram Fig. 1 shows a motor with two energizing circuits, C and D. One of these circuits, C, is connected directly with the line circuit, while the other set of coils D, is connected up in the secondary circuit of a transformer T. The primary coil P of this transformer is connected to the line circuit. The alternations of current in the line tend to establish in their passage through the coils C, a polarity opposed to that set up in the coils D, and if the currents in the two sets of coils accorded in their phases, no rotary effect would be produced. But the secondary current developed in the coil P' of the transformer will lag behind that in the primary, which lag may be increased to a sufficient extent to practically obtain the same result as though two independent currents were used to energize the motor.

In another form, shown in Fig. 2, the arrangement of the parts is similar to that shown in Fig. 6, except that a self-induction coil S is introduced into one energizing circuit of the motor. The effect of thus increasing the self-induction in one of the circuits is to retard the phases of the current passing therein to a greater extent than in the other circuit, and in this way to secure the necessary difference in phase between the two energizing currents to produce the rotation of the motor.

Shown diagrammatically in Fig. 3 is a type of motor in which two dead resistances R R'are included, respectively, in the energizing coils of the motor. No rotary effect will be produced as long as the resistances are equal, but by varying the resistance in one circuit the retardation of the current in that circuit will be varied and corresponding effects produced. For example, a reduction of the resistance in one circuit imparts to the motor rotation in one direction, while a reduction of the resistance in the other circuit will produce a rotation in the opposite direction. By means of the two resistances,

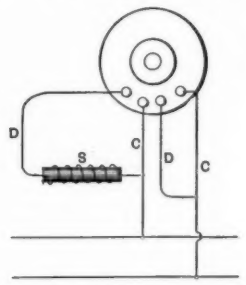


FIG. 2.—TESLA MOTOR WITH SELF-INDUCTION COIL.

therefore, capable of variation or of being bodily withdrawn from or inserted in the circuits by simple means, rotation of the motor is secured.

In Fig. 4 a self-induction coil S is included in one of the motor circuits and a dead resistance R in the other. The increased self-induction in one circuit thus produced acts to increase the difference of phase between the current in that motor circuit and the unretarded current in the line circuit. On the other hand, the introduction of the dead resistance in the other motor circuit reduces the retardation and brings the phases of the current in it more closely in accord with those of the unretarded current, thus producing a correspondingly greater difference of phase between the two currents in the energizing circuits C and D.

Two self-induction coils are shown in Fig. 5, one in each motor or energizing circuit. One of these coils, is much smaller than the other, and has less self-induction or counter electro-motive force than the other, so that the phases of current will be retarded to a less extent than in the other.

The two energizing circuits of the motor are shown in Fig. 6, connected in multiple arc to the line circuit, and in one of these circuits is a resistance R. Assuming the two motor circuits to have the same degree of self-induction, no rotary effect will be produced by the passage through them of an alternating current from the line. But if one of the motor circuits, as C, be varied or modified by the introduction of a dead resistance R, the self-induction of that circuit or branch is reduced, and the phases of current therein retarded to a correspondingly less extent. The relative degrees of retarda-

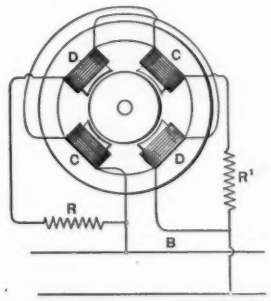


FIG. 3.—TESLA MOTOR WITH TWO DEAD RESISTANCES.

tion of the phases of the current in the two motor circuits with respect to those of the unretarded current in the circuit B thus produced will set up a rotation of the motor. Another type may be mentioned in which one set of energizing coils is of finer wire than the other or has a greater number of convolutions; or each circuit may contain the same number of convolutions, but composed of different conductors, as, for instance, one of copper and the other of German silver.

The Electrical Corrosion of Underground Pipes.

Mr. John M. Goodell, of Worcester, Mass., has written the following communication to London *Engineering* on the above subject:

In the interesting description of the Marseilles and St. Louis Electric Railway, Dr. Preller mentions the danger of electrically corroding underground pipes and cables by driving the current through the rails, wheels, car wiring, trolley connections, and overhead wire rather than in the more usual overhead wire to rail order. In this country we have had an experience with such a method of operation in Cambridge, Mass., one of the suburbs of Boston. There the wires, pipes and house connections in the earth disappeared in a remarkably short time, and the tramway company was forced to reverse the direction of its currents in consequence.

Even when the current is sent out from the power stations through the overhead wires, we are having considerable difficulty with electrolysis. In Boston and Brooklyn the trouble has generally been with the lead covering of the telephone wires, although in the latter city the water pipes are also affected. In Trenton, N. J., Columbus, O., Saginaw, Milwaukee, and Sault Ste. Marie, Mich., Los Angeles, Cal., and Hamilton, Ont., electrolysis of the water pipes, both lead and iron, has been observed, and in most of the cities the officers of the water department or of the railway have kindly sent me careful descriptions of the corroded pipe, and such local conditions as enables an opinion to be formed as to the nature of the corrosion. It seems perfectly certain to me that the electrolysis occurs as follows:

The return current through the rails and

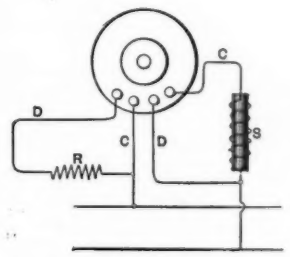


FIG. 4.—TESLA MOTOR WITH SELF-INDUCTION COIL AND DEAD RESISTANCE.

supplementary wires, if the latter are employed, reaches some point where the earth and the pipes embedded in it have less resistance than the metal circuit. Consequently the electricity follows along the pipes until the rails again offer a better path, when it returns to its theoretical path. From correspondence and personal observation of the effect of this fickle behavior of the return circuit, I am pretty certain that the electrolysis occurs at the points where the current leaves the pipes to return to the rail circuit, as might naturally be expected. The effect of the current is first to eat a series of little cavities in the surface of the pipe, which gradually enlarge until the metal may be completely destroyed around the entire circumference. A remedy that I have known to be applied successfully in a number of cases was to connect the pipes where corrosion was noticed with the rails of the tramway, so as to have a complete metal circuit. The leading remedy is one which the railways are slowly adopting as a matter of economy, without any reference to the wants of the water works, telephone, or gas engineer, viz., the better bonding of the rails. The connection illustrated by Dr. Preller is not considered the best practice in this country to-day, although it was two years ago, when good bonding was not regarded as so important as now. In the single track illustrated the cross section of the two rails is about 10.8 square inches, which is equivalent in conductivity to about 1.6 square inches of copper, speaking approximately. To bond this single track, there are two copper and two iron wires, each seven millimetres in diameter, which have a total conductivity of about 0.14 square inch of copper. That is to say, the conductivity of the bond is only about a tenth of that of the rails. In this country we are now making the bonds heavier, and thus try to prevent the watts from straggling on their return home.

The Trolley on Manhattan Island.

On Sunday, December 24, the Union Railway Company, of New York, in a manner which could not be called anything less than summary, started upon laying the spur for their main line through One Hundred and Thirty-fifth street. The company has been endeavoring to secure consents for the One Hundred and Thirty-fifth spur ever since December 27, 1892, when they secured permission from the Board of Aldermen to occupy several streets and avenues south of the Harlem River for connections between

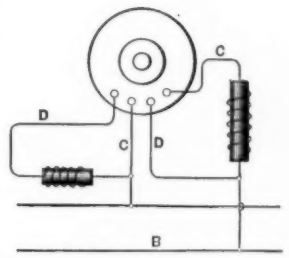


FIG. 5.—TESLA MOTOR WITH TWO SELF-INDUCTION COILS.

their annexed district lines and the west side surface and "L" roads. But the residents of this district were unwilling that the company should occupy these streets, and very few consents were obtained. Altogether, it is stated, less than 1,000 feet of consents from property owners were secured. Notwithstanding this fact, the officials of the Union Railroad declared their intention of securing the line through One Hundred and Thirty-fifth street, it being one of the most valuable connections asked for. On Christmas day the residents saw a contractor busy at work finishing the line through One Hundred and Thirty-fifth street. A committee of householders, with Mr. William Whitehead as the chief factor, vainly hunted around the city for some municipal authority who could grant them an injunction. None, however, was found, and they were obliged to return to their homes unsatisfied.

This trolley line is the first one to run on Manhattan Island; the trolley road, known as the Huckleberry line, has a terminal station at One Hundred and Twenty-ninth street, which is but a few steps from the bridge, from whence the line goes in branches to Fordham and neighboring localities. It will be hard to foretell what will be the outcome of the war between the railroad company and the opposition, but meanwhile the tracks are laid, and it is to be supposed that the line will be shortly in operation. Instead of raising an outcry against the trolley itself, there can be little doubt that more and better results could be obtained by insisting upon the employment by the com-

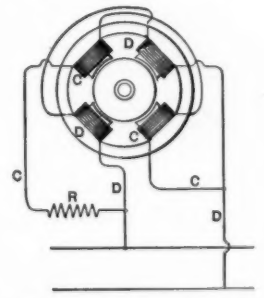


FIG. 6.—TESLA MOTOR WITH ENERGIZING CIRCUITS IN MULTIPLE ARC.

pany of the very best materials for construction, and devices which would reduce to a minimum the danger to life and limb.

A New Telephone Exchange for New York.

The Metropolitan Telephone and Telegraph Company has issued invitations to the press and the telephone subscribers in that district to a private view of the new telephone exchange at 95 Broad street, from two until five o'clock to-day.

Thoughts on Cosmical Electricity.

ABSTRACT OF A LECTURE DELIVERED BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, BY PROF. ELIHU THOMSON.

Professor Thomson prefaced his remarks by stating that it was not his intention to give an illustrated popular lecture, but rather to present to the electrical section of the Institute a number of thoughts which had come to him, and which must be regarded as in the nature of speculations of guesses. He had attempted to apply known principles to conditions of the heavenly bodies, and he thought there was much to learn in this field.

Beginning with the consideration that as we rise from the earth's surface to different altitudes there appears to be a gradual increase of potential with respect to the ground, such that at 1,000 feet, as at the top of the Eiffel tower, there may be 10,000 volts difference between the air at the top and the surface, he assumed that this difference might increase as we reach high altitudes, and that at 20 or 30 miles the potential difference might amount to 1,000,000 volts, more or less. This would seem to indicate the possession of a positive charge by the higher layers of the atmosphere. He stated, however, that it had not yet been proven that a pure gas could carry a charge of electricity, and instanced the case of a drop of water suspended in the air and charged to a certain potential; if the air were dry and the drop evaporated, the potential would rise gradually until when it was entirely evaporated the potential would be infinite. This consideration would be based on the fact, if it be a fact, that liquids in evaporating do not part with their electricity. The increased potential of the drop, however, might have other effects, such as the repulsion of its particles and its division into an extremely comminuted state. Still, on evaporation to pure vapor the electricity must go somewhere.

After stating the nature of the electrical charge as dependent upon capacity and potential, he showed that whenever the capacity is diminished the potential with a given amount of electricity rises, and *vice versa*, but went on to state that attraction and repulsion, and other phenomena could be explained by the general tendency of all bodies to increase capacity. He adduced considerations going to show that there was a relative *repulsion* between charges of electricity besides the attraction between opposite charges, and that, therefore, the lines of electrostatic stress would agree with those of magnetism in their tendency to shorten and also to spread laterally.

He then took up the question as to whether a perfect vacuum is or is not a conductor of electricity and brought forward the results of recent investigations as showing that an excellent vacuum is not a conductor, but, on the other hand, is a most perfect insulator. Taking this in connection with the fact that dense air is a good insulator, that rarefied gas is a fair conductor, and that the solid body of the earth is a conductor, he compared the earth to a huge condenser possessing a positive charge in the outer layers, while the earth itself might be less positive or negative. Using the result of Professor Rowland's works on the movement of a charged body giving rise to magnetism and principle of an air condenser, he put forward the idea that the earth being a huge rotating condenser, with the positive charge in the upper layers of the atmosphere and the negative charge at the ground, it would necessarily follow that magnetism could be developed in the region between this upper layer and the earth by the rotation of these charges.

He then traced the actual direction of the magnetism which would be produced, finding that the direction was the proper one to accord with facts and that the compass needle indicates the direction. He mentioned that an idea had come to him that possibly thunder storms were, in a measure, due to flaws in the dense air as a dielectric, and explained in detail, somewhat, his thoughts on this subject. He drew attention to the consequences which would follow the possession by a mass of nebulous gas of a charge of electricity; this, if insulated in space, would, as its volume diminished by the radiation of heat and condensation, gradually increase in potential, however small the charge originally possessed. The sun might, therefore, be a charged body having a relatively high potential, which potential would undergo elevation on further condensation. He put forward, as a thought on this subject, a possible explanation of the solar periods as due to electrical states, the sun reaching a certain potential by the repulsion of small electrified particles loses that potential by the passing of the coronal stream, and not only a part of the charge which it possessed, but also a considerable amount of the charged material which might be encountered by the earth in its movement around the sun, and so give rise to an auroral display. He showed that the action would necessarily be the periodic one. He showed the tendency of electrified bodies to lose their charge, especially in the presence of rays of light and the higher rays of the spectrum, and thought that this action might possibly have some relation to the possession of and disposition of charges by the heavenly bodies.

He concluded the lecture by stating that it was possible, in his opinion, that temporary stars, that is, stars becoming visible and then fading away, might, therefore, be explained on an electrical hypothesis, viz., that charged bodies possessing a difference of electrical potential when they approach near enough, might exchange electricity between themselves on the grandest scale, giving rise to a uniformity of charge on their leaving each other; that this would naturally be done in a vast display which would only last for a moment of time. He stated in conclusion that these were only thoughts after all, but such as he believed would be of interest to the members of the section.

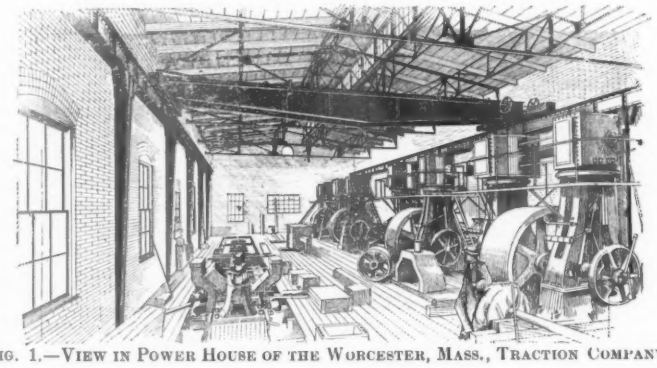


FIG. 1.—VIEW IN POWER HOUSE OF THE WORCESTER, MASS., TRACTION COMPANY.

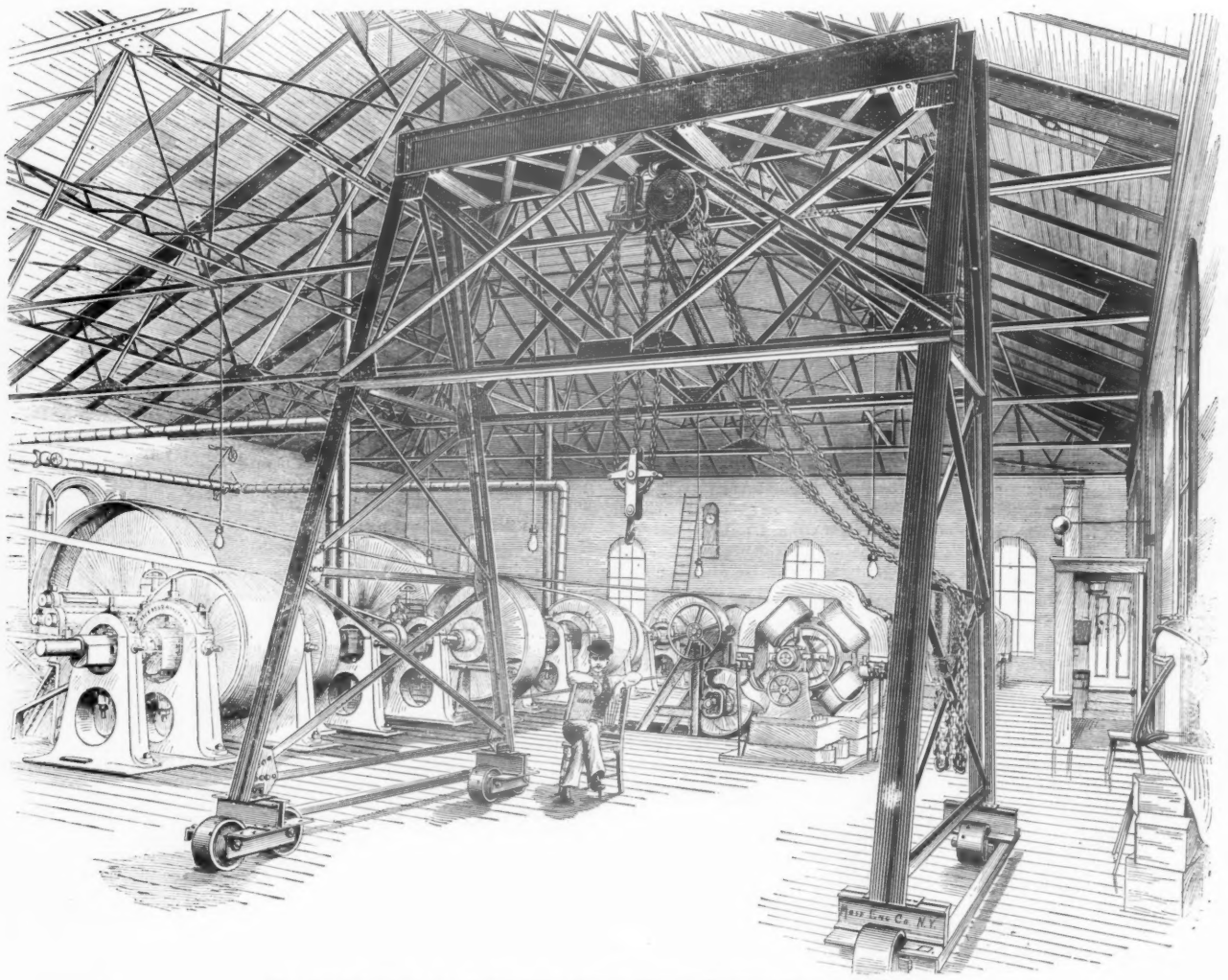


FIG. 5.—INTERIOR OF AN ELECTRIC POWER HOUSE, SHOWING PORTABLE CRANE.

The output of the American Bell Telephone Company for the month ending December 20 was as follows:

	1893.	1892.	Inc.	Dec.
Gross output.....	4,892	6,770	.....	1,878
Returned.....	6,126	4,056	2,070	.....
Net, def.,	1,234	2,714	.....	3,948
Fiscal year:				
Gross.....	81,418	93,579	.....	12,161
Returned.....	65,438	51,247	14,191	.....
Net.....	15,980	42,332	.....	26,352

Modern Power House and Car Shed Construction.

The construction of power houses and car sheds for electric railway companies is fast assuming large proportions in this country, and probably no one company has had as great experience in this class of construction as the Berlin Iron Bridge Company, of East Berlin, Conn. It is our pleasure this week to illustrate several buildings designed and built by them for this purpose.

Fig. 1 is an interior view in the power house of the Worcester Traction Company, Worcester Mass. The building is 93 feet wide and 120 feet long, divided into two parts, an engine room and boiler room. The engine room is 47 feet in width and 120 feet in length. The whole interior floor space is controlled by a power crane, which greatly facilitates the placing of the machinery and the moving of the different parts when repairs are necessary. The framework of the building is entirely of steel, the side walls being of brick placed between steel columns. construction of this building is the same as that of the power house, *viz :* the frame-work being entirely of steel. The steel side posts for supporting the second floor are enclosed in the brick wall; in fact, the entire support of the building is the steel frame-work, the light brick wall between the side posts being used only as a protection from the weather, and not as a support. The second floor is supported by iron girders, which in turn are supported by columns and girders as shown in the illustration. It was desired to have the roof of the car house flat, so that plank, with tar and gravel covering, was used, instead of corrugated iron, the roof being so flat that corrugated iron could not be used. The construction is practically fire proof, there being so little wood-work in the floor and roof, and what is used being of such a heavy nature it would be almost impossible, under any conditions that might arise, to set fire to the building.

Fig. 4 is an interior view in the car shed designed and built by the Berlin Company for the New Orleans and Carrolltown Railroad, at New Orleans, La. This building is entirely of steel, that is, the main frame-work being of steel, covered with corrugated steel. It is 128 feet in width and 300 feet in length. The sides of the building are covered with corrugated steel to a distance of 10 feet from the ground. From this point the sides of the building are left entirely open, so as to allow free intercourse between the building and the outside. The ends of the building are covered with corrugated steel in the gables, but below the tie beam the corrugated steel is entirely omitted. In the climate of New Orleans it is not necessary to enclose a building of this kind, on account of warmth, as the temperature never falls to the freezing point. The construction of this building is so well illustrated that further description seems unnecessary.

Fig. 5 is an interior view in a power house designed and built by the Berlin Company for the same parties. This building does not differ in general construction from other buildings for similar purposes designed and built by the Berlin Company. Especial attention, however, is called to the portable crane shown in the foreground. A traveling crane to span the full width of the power house would be very expensive, and in order to limit the expense, and at the same time have an effective method of moving the machinery about the building, the portable traveling crane shown in the foreground of the illustration was designed and built. It is so arranged that it can be easily moved to any part of the building, and, having a capacity of five tons, different parts of machinery can be raised and lowered easily and without very much expenditure of time and money.

All of these buildings are models, and are worthy the careful consideration of traction companies.

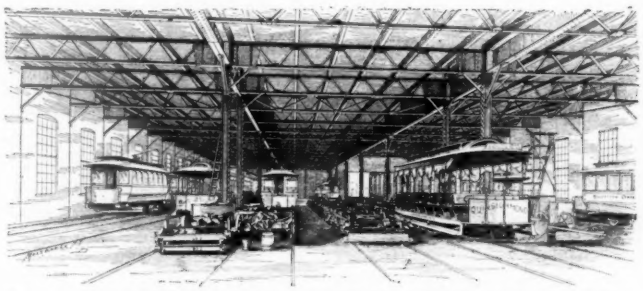


FIG. 2.—FIRST FLOOR OF WORCESTER TRACTION COMPANY'S CAR HOUSE.

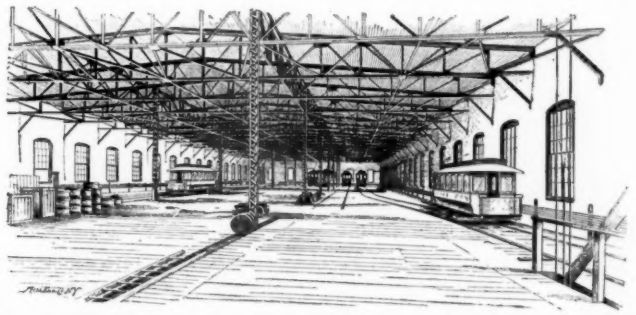


FIG. 3.—SECOND FLOOR OF WORCESTER TRACTION COMPANY'S CAR HOUSE.

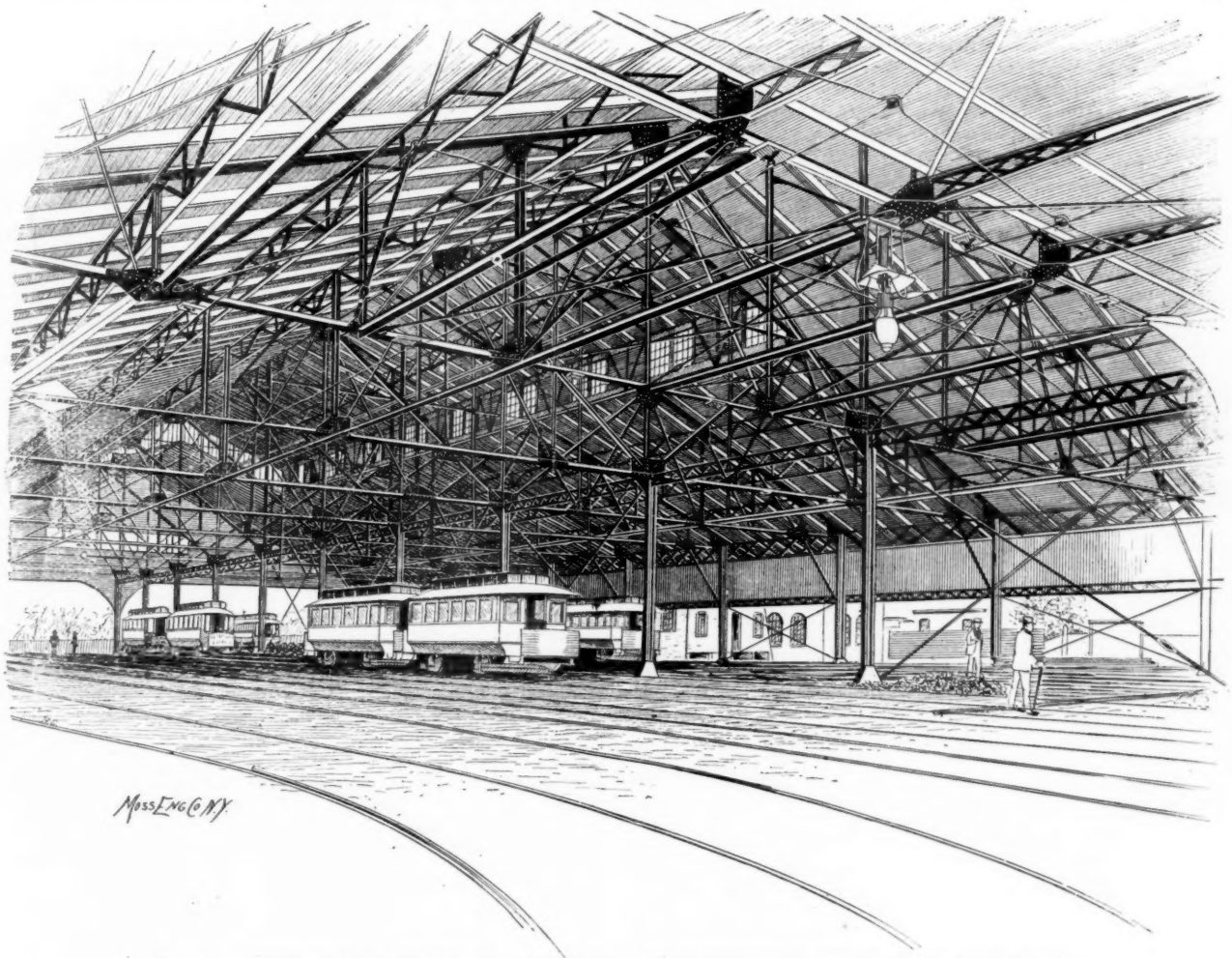


FIG. 4.—INTERIOR OF CAR SHED FOR THE NEW ORLEANS AND CARROLLTON RAILROAD AT NEW ORLEANS, LA.

Fig. 2 is an interior view of the first floor of a car house designed and built by the Berlin Company for the same parties, and Fig. 3 is an interior view in the second floor of the same house. This building is 128 feet in width, 300 feet in length and two stories in height, the two stories being connected by an elevator, so that the cars can be easily moved from the first floor to the second floor with very little expense. The

Electrical Workers' University Extension.

About 400 members of the Electrical Workers' Union, No. 3, of New York, have formed themselves into the Electrical Workers' University Extension Club, under the oversight of Columbia College. This club is formed for the purpose of increasing the knowledge of the members in the technicalities of their craft. Ten lectures have been arranged for in the large hall of Cooper Union, beginning on January 15. The admission to the course is $2, or 25 cents for each lecture. President Low, of Columbia College, has offered to contribute $1,000 toward the expenses. The first lecture will be by C. O. Mailloux, consulting electrical engineer, on the subject, "Batteries—Primary, Secondary and Thermo."

Judgment Against The Union Electric Company.

Judgment for $10,045 was entered on December 27, by default, against the Union Electric Company, of No. 45 Broadway, New York, in favor of Stephen R. Bradley, the president of the company, of which Stephen R. Bradley, Jr., is secretary and treasurer. The company was incorporated under West Virginia laws in July, 1891, and has a capital stock of $500,000. The company manufactures electric storage batteries. The claim of President Bradley is for money advanced.

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Inventors with new telephone systems may be said to be whetting their knives.

Now is the time for the business man to "brace up" and have faith in this great country of ours.

Mr. Thomas A. Edison has been very quiet for a year past. A great many are of the opinion that some new things will soon be forthcoming from his laboratory.

Two hundred thousand dollars is to be expended in supplying an electric light plant for the Capitol at Washington. This will shed needed radiance on a variety of subjects.

We are pleased to note that Postmaster General Bissell in his annual report recommends electric mail cars for rapid mail delivery in large cities, and between a city and its suburbs.

From the letters received at this office the news concerning General Electric, which we published last week, evidently was gladly received. The ELECTRICAL REVIEW claims to be reliable.

Everyone should endeavor to feel pleased over the outlook for 1894. The ELECTRICAL REVIEW having added over 1,000 new subscribers during the month of December, feels correspondingly joyful.

There is much inquiry among telephone companies as to what the course of the American Bell will be after January 31, 1894. It is a wise parent (company) that looks well after the interests of its children.

A daily paper carefully explains that the reason the electric lights in trolley cars sometimes go out is because the trolley slips off the wire. With a wealth of detail it is carefully demonstrated that two electric cars require more power than one.

We are glad to learn from England that the recent Harness exposure in the *Pall Mall Gazette* has practically cleared the air of electrical quackery over there, so that electric belts have hardly any sale at all. We are also glad to know that it is an old electrical journalist to whom the credit of the exposure must be given.

LIFE GUARDS ON STREET CARS.

The problem of a satisfactory device on our rapidly moving surface cars, whether electric or cable, is, we admit, a difficult one, but it must and will be solved. Merely hanging on the front of the car a gracefully shaped netting, armed at its lower edge with a stiff bar or tube, does not answer the purpose. In fact, it seems that no stiff affair can be satisfactory, so long as it is attached to the platform. The platform and its timbers are part of the car-body, and as this must be mounted on springs to render riding bearable to the passengers, there is always to be expected more or less galloping motion, or oscillation of the car-body, which does not occur in the running-gear. This is particularly noticeable on tracks which have got out of repair by continued use. On this account it is recognized that any life guard attached to the platform must clear the paving by from four to eight inches. But such a device is more of a bone-breaker than a guard against injury. If a person be knocked down or fall for any reason, the chances are in favor of his being forced under the guard and getting mortally hurt by the guard itself before the wheels are reached. This has happened and will happen again.

Remedy by constructing the guard closer to the paving is not practicable, because of the motion above noted and the uneven character of the best pavement after a few months' traffic. The difficulty is enhanced by the frequent dropping of stones and other obstructions from carts or trucks passing along the street. Remedy is proposed by projecting the platform guard several feet horizontally in front of the car. This, however, is not a complete cure, and cannot be. A car is fitted with such a device, and a test made by standing a dummy in the street and then sending the car forward rapidly. The guard strikes the dummy about the shins, and it very successfully topples over into the horizontal netting. So would a human being who should stand perfectly still and await the blow. But accidents seldom happen that way. Suppose a person happens to get in the way, and, as generally occurs, suddenly realizes that the coming car is almost upon him. He may possibly stand still, but he generally responds to a sudden impulse, which naturally is to run, and ahead of the car. A child attempts to cross the track in front of the car, or a passenger on one car alights in front of a coming car. In all such cases the person is in motion, and usually rapid motion. The feet are alternately lifted, and when the guard or fender strikes it is just as likely as not to trip the pedestrian in such a way as to cause the resulting fall to be forward, and quite likely at the same time to bring one foot under the fender and the other above it. The result is a dreadful wounding or sensational killing of an unfortunate human being. If it were possible to carry these extension guards with their edges close down within a couple of inches of the street surface, a vast majority of these accidents would have but trifling results. But that cannot be done for the reason stated, and this reason becomes more and more controlling as the car body is increased in length. Even if galloping motion do not occur, a considerable vertical play is necessary to allow for the action of the car springs between no load and full load.

The new Third avenue cars, similarly to most cable cars in this country, have a life guard consisting of a strong frame with wood faces carried on the truck and arranged directly in front of the wheels and along both sides, the wood strips being trimmed to within two inches of the street surface. Being suspended on the truck, oscillation is practically absent, and a very close fit can be attempted. This guard apparently will effectually prevent mangling by the wheels, but it is, like the others, subject to several objections. Before a person can be benefited by the guard, he must lie on the pavement till the guard strikes him. But if he does not fall in the first instance, he is knocked down by the dasher or bumper, and if not rendered unconscious at once, will make frantic efforts to grasp something, his arms or legs come in contact with the brake-staff, step, brake-levers, floor timbers, or drawhead, and the mangling is again effected.

Folding or elevated guards adapted to be thrown down by the foot of the motorman or gripman releasing a catch have been proposed. They are attractive in principle, but they are open to objection. The releasing mechanism will be liable to get out of order at times, and even if in order, the motorman or gripman cannot always act promptly enough, especially when adults or children attempt to run across the tracks just as the car comes along. The difficulty is more easily appreciated when it is realized that, even at the old time horse car rate of six miles an hour, a car travels just a trifle under nine feet in one second. Few men are so constituted that in a startling emergency the mind can realize and decide what to do, telegraph along the nerves and put the muscles in action, all inside of one second. Yet that one second frequently is all the margin between rugged health and ghastly death.

Still we believe a satisfactory and reliable guard, both of life and limb, will yet be produced. It will be simple and more or less automatic, and will not only prevent mangling and broken bones, but will prevent a fall in the filth of the street. Many railway companies are now and have been at work on the problem, and eventually they must succeed. They are all keenly alive to the necessity of a good life guard, and once a universally effective device is perfected, there will be little urging necessary for its adoption. Let us hope the day is near, for then we will be not only free from the constant dread of these accidents, but will thereafter be spared the scare-heads of the daily press about the "deadly trolley" the "cable juggernaut" and other sensational stuff, which may sell papers, but does not prevent riding.

PERPETUAL MOTION ONCE MORE.

Here is what the latest self-suspected inventor has to say:

READING, PA., Dec. 12, 1893.

TO THE EDITOR OF ELECTRICAL REVIEW:

Will you kindly favor a new reader with your opinion of the following perpetual motion idea? Fit up a boiler so that it may be heated by electricity. Get up steam by any means convenient. Attach a dynamo to your engine, start the engine; the dynamo will generate sufficient current to keep up steam in the boiler. Will it? It seems to me it will at least largely assist, thus saving a great amount of fuel.

You have too much machinery by far, and we can go you one better. Drop your engine, boiler and electric heater. Connect your generator in circuit with a motor, put a belt from the motor pulley to the generator pulley. Start the generator "by any convenient means." The generated current will immediately start the motor, and the motor will then drive the generator. No engine, no boiler, no heater, no fuel; only a little oil, and a new brush now and then, and there you are!

In the numerous office buildings situated in this city and provided with passenger elevators we notice the quiet indicators at the elevated shafts, most of them the kind known as liquid indicators. Oil is often used, frequently glycerine is employed, but there is no sound, nothing attractive other than the moving liquid which, it is true, shows the direction of the moving car. There can be little doubt but that among the numerous electrical inventions there is one or even more for an electric elevator indicator. With the liquid indicator the eye is caught, but something is wanted which will catch the car as well as the eye. Here is a chance for the inventor.

We are informed that rooms at the official headquarters of the National Electric Light Association, at Washington, are being rapidly engaged and the indications are that a great many ladies will attend the convention. Social and official life will be at its best on February 28, March 1 and 2 and the next convention promises to be one that will be eagerly looked forward to as well by the ladies as the men.

CORRESPONDENCE.

OUR WESTERN LETTER.

The City of Winona, Minn., may shortly be in the market for arc lighting apparatus.

Mr. E. Nashold, 935 Monadnock building, is successfully introducing the automatic alarms of the Electric Heat Alarm Company in the West.

The Jenney Electric Motor Company, of Indianapolis, is slowly getting its affairs into shape, and if not pressed to the wall by creditors may be able to pay in full.

The "Mac Tape." — The Metropolitan Company are pushing the sale of this high grade tape prepared for wrapping armatures and fields, and for insulating joints.

Mr. James N. Cropper has been appointed receiver for the Muncie Electrical Works. A press report indicates that J. McNamee supplied the money and R. Chamberlain the experience.

The Chicago Fire Underwriters' Association have expressed their appreciation at the action of John P. Barrett in so materially aiding to reduce the fire hazard from electrical causes.

The Technical Society of the Pacific Coast will hold its next meeting on Friday, January 5, in the rooms of the society, 819 Market street, San Francisco, when Mr. Charles F. Hoffman will read a paper on the "Red Point Mine."

Mr. W. L. Arnold, manager of the St. Louis office of the General Electric Company, passed Christmas with his brother, Mr. B. J. Arnold, and indulged in pheasants from an English estate adjoining that of the Prince of Wales.

The Goodrich Hard Rubber Company, of Akron, O., is preparing to send to its customers the usual New Year remembrance, and it is safe to say that it will be very carefully preserved. It is worth while sending an occasional order to the Goodrich Company merely to have one's name on the mailing book.

The Washington Electric Company, 197 South Canal street, Chicago, has issued an attractive catalogue describing and illustrating the specialities it manufactures. The preface contains a sentence so familiar to editors, "We have come to stay," that the question naturally arises, Is Louis Stein an ex journalist?

Cushing & Morse did not forget their many friends on Christmas Eve, for each one received a neat little case labelled "Have one with us?" and containing one of Moralesy's best cigars, and a flask of Du Vivier's "Old Coronet" rye whiskey. Needless to say that the health of these successful Kerite agents was often referred to.

A Golden Opportunity.—Agents desiring a ready selling motor should secure exclusive territory for the well-known Adams motors and dynamos. Mr. Adams has removed from Indianapolis to 100 Beacon street, Worcester, Mass., and will at once place upon the market a full line of apparatus, having forged iron field magnets and fireproof insulation for armature cores. The agency for Cook County has probably been given to a gentleman having an office in The Rookery, Chicago.

Mr. W. W. King, city passenger and ticket agent for the Chicago, Burlington and Quincy road, has resigned his position. After January 1 he will be general freight agent for the Chicago Sugar Refining Company, Taylor and Beach streets, and will have entire charge of the freight department. Mr. King will be remembered by all who traveled on the special electric train to the Kansas City meeting, for his untiring efforts to render every assistance that would add to the enjoyment of the trip.

The Northwestern Telephone and Electric Company has been formed in Milwaukee with the avowed intention of competing with the Wisconsin Telephone Company after January 30. Periodically these local companies spring up, air their intentions in the local press to the extent of many columns, absorb the good dollars of the gullible and—go out of existence. This coming Spring will see many new companies formed. Will the promoters frankly explain that the principal patents covering the apparatus and methods required in operating central stations are all controlled by the Western Electric Company and the American Bell Telephone Company? Or will the old game of transferring money for experience be played?

Prizes for Car Men.—The various street car lines in Chicago have issued bulletins announcing the awarding of prizes for "efficient train service," for "best general appearance" and for "the best record in avoiding accidents, blockades and delays." Twenty-four men on the South Side lines won prizes in gold, the first prize being $100; second, $50; third, $25; and fourth, $10. On the West Side lines 38 men won prizes of $25, in cash, or the option of a 10 day's furlough. On the North Side lines 16 men were given prizes, four of $75 each, and 12 of $25 each. A street railway official believes this is money well expended as it draws the employés into closer relations with their immediate superiors, results in more consideration being shown to the public, and in a neater personal appearance.

World's Fair.—Colonel J. W. Blaisdell will remain in charge of the Electricity Building and contents until April. The postal carriers have been withdrawn and mail is no longer delivered in the grounds. More than 3,000 cases of foreign exhibits are packed ready for shipment, and 20 car loads are daily started *en route* home. The dismantling of the Intramural elevated structure is being pushed, and the working force have passed the Mount Vernon station. A heavy traveller loads the material on a train that hauls it to the power house where it is unloaded and stocked for shipment, this arrangement saving the hauling over the grounds. All the engines and generators save the vertical Williams and its direct connected generator have been removed. The boilers still remain, but some of the pumps and other machinery have been shipped away.

Municipal Lighting.—Professor Barrett is elated over the final passage of his long cherished ordinance authorizing the purchase and placing of conduits, cables and lamps for street lighting, to be paid for by special assessment. The popularity of the scheme is well illustrated by the large number of signatures to the petitions asking for the extensions in front of their respective properties. The present capacity of the power houses is sufficient to supply many hundred more lights than the city can afford to install.

Following is the ordinance as passed by a vote of 54 yeas to 4 nays:

Section 1. That hereafter all local improvements, consisting of electrical conduits, cables, lamp posts, switches, and lamps necessary for the purpose of furnishing electric light for municipal purposes, shall be paid for by special assessment to be levied upon the property benefited, provided, however, that all such improvements and assessments shall only be made or levied on such property as shall have petitioned for the same by a majority of the owners of frontage to be benefited.

Sec. 2. That the cost of power houses, real estate for power houses, and the necessary machinery for furnishing electric lights, and the maintenance thereof, shall be paid for by general taxation.

Sec. 3. This ordinance shall be in force from and after its passage.

What Does it Mean?—The invitations for proposals for city lighting now being sent out by several municipal authorities contain no reference to double carbon arc lamps, but specify single rod double service lamps. That an arc lamp having a single, simple mechanism, feeding an elliptical carbon for 18 hours, or longer, should be preferred to the complicated mechanism of the double carbon lamp is readily apparent. But how many companies are in a position to furnish such lamps? That many lamps of that description are in service is obvious, for one of the smallest of the carbon companies have shipped nearly 500,000 pairs of elliptical carbons this year, while the largest carbon company has probably sent out 2,000,000 pairs of these carbons. Thus it is safe to assume that more than 10,000 single arc lamps are giving excellent all night service, and displacing that many of the old time double carbon lamps that have caused central station managers so much worry, owing to the legal complications.

The Central Electric Company, Chicago, have found ready sale for all the opal and colored lamps they could secure during the last month, a majority being used for holiday decorations.

F. De L.

Chicago, Dec. 30.

Electricity on the Erie Canal.

In a report to President Evan Thomas, the Committee on Canals, of the New York Produce Exchange, suggests as follows, how the Erie Canal may be benefited:

"The sovereign remedy for all and every evil afflicting this great artificial waterway, in the opinion of this committee, lies in the hope, now beginning to appear, that in some way, by the application of electrical appliances to the propulsion of canal boats, the cost of moving them may be reduced to a point at which no other method of transportation can compete, and this, too, without impinging on a fair return to boat owners for their investment, or reasonable wages to the boatmen. In fact the security of property investments on the canals depends on the achievement of this object."

The Committee on Canals has also issued a general circular, one paragraph of which reads:

"While this committee will not undertake to exploit special schemes or plans by inventors and others looking to the substitution of other methods than those now employed in passing traffic through the canals, it will, nevertheless, furnish every consistent facility to those working in the direction named, for displaying models and drawings, and for caring for papers and documents relating thereto."

William Richardson, known as "Deacon" Richardson, a prominent street railway man of Brooklyn, N. Y., died of pneumonia Saturday, December 30. He left a fortune estimated at from two to five millions.

FINANCES OF A YEAR.

THE UNFORTUNATE PAST AND THE HOPEFUL FUTURE REVIEWED BY OUR FINANCIAL EDITOR—AN INTERESTING AND SUGGESTIVE RECORD.

The year which is closing has been the most disastrous in the history of finance. Its entrance was accompanied by a period of inflation, and it was wound up by a period of complete liquidation.

The causes which contributed to this end are understood, in a general way, by the majority of readers, and may be enumerated as a culmination of the country's silver policy, threatened tariff legislation and anti-railroad legislation. The latter is, perhaps, as important as either of the others. Each one has had the effect of intensifying the others. The three combined have constituted a force almost irresistible.

Years of prosperity are always attended by fictitious values, unwarranted credit and corruption in business methods. The liquidation which followed the panic has been a probe that has pricked every bubble and left every industry where it should be, either a wreck or on bed rock. The story of the panic will never be comprehensively told. It is a record of the complete annihilation of houses whose credit was beyond reproach, a depreciation in the value of securities that has wiped out millions, and the curtailment of business enterprises, which has thrown out of employment about 20 per cent. of the labor of the country. It has rendered the soup kitchen a national institution.

The only encouragement in the situation is the firm conviction that the worst has been seen, and that every development from now on will be progressive instead of retrogressive. The silver issue is now out of the way, and our monetary system is now no longer in danger of being debased by cheaper metal. Tariff legislation, which has exercised an adverse influence because of its uncertainty, is now speedily promised, while the railroad systems of the country have been taught a lesson in economics which they cannot otherwise than profit by. Uncertainty is always killing the business enterprises, as its direct effect is curtailment. Pending the enactment of the tariff measure almost every line of business has practiced rigid restriction. This has had the effect of reducing both raw material and finished stocks to the minimum. The passage of the tariff bill is certain to start up trade, and when the start is made it will necessarily become brisk, as stocks of all kinds are depleting.

Anti-railroad legislation, dating back 10 years, culminated during the panic. Unjust laws, either of State or national origin, which prevented a road from obtaining equitable rates for traffic, or pooling against unnecessary and unwarranted competition, has reduced the earning capacity of the roads. This in turn has caused a discrimination against their securities, stopping all improvement. With the curtailment of betterments, the iron and all kindered industries have suffered. The railroads were the first to reflect the business depression by a falling off in their earnings. This rendered them unable to care for and pay off their floating debts from their income, and so destroyed their credit that they were unable to borrow money for that purpose. As a result we find nearly 30 per cent. of the railroad mileage of the United States in the hand of receivers. During this year 74 roads, representing 32,397 miles and an aggregate capitalization of $1,651,116,000 have been placed under the protection of the courts. The inevitable result of this impoverishment (which reflects a similar liquidation in almost all lines of business) will be a reorganization on a lower and more equitable basis, a more intelligent and economic administration of railroad affairs, and more just railroad laws.

Conditons which have been operative in railroad circles apply to other lines of business, as is shown by *Bradstreet's* table of failures for the year. The total number of failures is 15,560; assets, $262,415,851; liabilities, $402,427,818. In 1892 the failures amounted to 10,270; assets, $54,774,106, and liabilities, $108,596,233.

The stock market, which is a barometer of industry, has reflected the condition of the country. The business panic occurred in August and September, the lowest prices for stocks being in July and August, Wall Street in the panic, discounting it by about 30 days. The highest prices were in January.

Accompanying will be found a table showing the highest, lowest and last prices of the more active electrical securities. Those that were at all active reached the lowest prices in July and August and the highest in Jannary and February. The last sales show a considerable improvement in prices over the lowest in both the active and inactive stocks.

General Electric has been the most active of the list and suffered the most severely. Its highest point was 114¼ on January 15. From this figure it gradually receded until 30 was reached, on one of those dark days of July when it seemed as if the bottom had dropped out of Wall Street.

The cause of General Electric downfall was a large floating debt and the form in which its assets were held. These consisted of stocks and bonds of local companies, the par value of which was $16,220,391. It was no trouble for General Electric to carry these securities in the times of easy money, as they were readily taken as collateral. When money became tight (running in one instance to 71 per cent.), and bankers became very discriminating against collateral, General Electric found it impossible to borrow money to care for its floating debt. It was forced to sell its choice treasury assets for what they would bring. Five thousand shares of Boston Electric Illuminating, and 10,000 shares of New York Edison Electric Illuminating, were parted with for ready cash. And still the floating debt to the extent of about $4,500,000 was uncared for. The company had adopted the policy of doing business on credit, taking these securities in part payment and notes and other promises to pay. When its credit was curtailed it found these evidences of assets almost impossible to realize upon, and, at least, during three times in the year was in imminent danger of a receivership. Owing to its strong financial backing it was able to fund its debt by depositing something like $11,000,000 of these securities, bills receivable and other similar collateral, in a trust, known as the Illuminating and Railway Properties. It received therefor $4,500,000 cash which it applied to the liquidation of its floating debt. Coincident with this financiering it adopted the policy of doing business on a cash basis, instituted the most rigid economies in its manufacturing and administrative departments, passed its dividends on the common and preferred stock, and stands to-day in a remarkably healthy condition, general business considered.

During the year Western Union has been very strongly held. It touched 67⅛ on July 26, the week of the panic, but quickly rallied into the 70's, and since that time has sold for the most part in the 80's, and two weeks ago touched 93. Its comparative stability has been due to the close holdings of the stock, the demand which it has had from investors and the showing which is being made by its earnings.

Commercial Cable sold last March at 185. It sold in February at 180. This was the last sale. It is now bid 120.

Edison Electric Illuminating sold at 131⅞ in February, and 71¾ in August. The stock has not been active during the year and would not have receded to the low price quoted had there not been imminent danger of General Electric throwing a large block of it on the market at the time it was the most sorely pressed for money. This dumping was prevented by a sale by General Electric of 10,000 shares of the stock to Kuhn, Loeb & Co., said to be at par. During the last few month the stock has ruled at about par. The property is in wonderful healthy condition and is highly prized as a 6 per cent. investment.

Bell Telephone sold at 212 in January and 166 in July. Since the latter date it has ranged in the 80's and 90's. The expirations of certain of its patents this year, and the coming expiration of patents next year, has been in part discounted by its prices. It has continued to pay quarterly its 3 per cent. regular and 3 per cent. extra dividend.

North American, which holds a place in the electrical list, owing to its lighting and transportation interests, in Milwaukee and Cincinnati, suffered a very severe blow in the insolvency of Northern Pacific. It is a banking company, and at one time during the year held largely of Northern Pacific, Wisconsin Central, and Chicago and Northern Pacific securities. Its low price indicates that many of its assets were sold and nothing but a shell remains. Its highest prices for the year were around 11, and it is now selling between 3 and 4.

The table follows:

	Range in 1893.				Last Sale.
	Lowest.		Highest.		
General Electric	July 29	30	Jan. 16	114¼	34¼
" pfd	Aug. 23	44	Jan. 18	119	57
Western Union	July 26	67⅛	Jan. 20	101	87⅝
Am. T. & Cable	Aug.	100	Feb.	130½	88
New Eng. Telephone	Aug. 12	47¼	Jan. 20	61¼	47¼
Erie Telephone	Aug. 10	36½	Jan. 16	50½	43¼
Commercial Cable	Feb.	180	Mar.	185	180*
Edison El. Ill	Aug.	71¾	Feb.	181	97
Interior Conduit & Insulating	Dec.	33¾	Jan.	71	.....
Postal Telegraph	Nov.	47¾	Feb.	83¾	55
Bell Telephone	July 26	166	Jan. 27	212	185

*120 now bid, last sale of record in February.

New York, Dec. 30, 1893.

Vancouver or Monterey.

WHICH SHALL BE THE TERMINUS TO THE FRENCH TRANS-PACIFIC CABLE?

[*From the New York Sun.*]

The latest news concerning a Pacific cable, which comes from the Antipodes, where is now centered the activity of those interested in promoting the project, is that orders are already placed for its construction as far as the Fiji Islands, that it will be completed to the Samoas within 18 months, and thence through to this continent in good season. The state of lethargy in which the project has lain for years has, in the past few weeks, been succeeded by a condition of strong competitive activity, an actual race between rival interests anxious to at once construct the cable.

The *Sun*, in a previous edition, has told how this awakening begun; how the British and Canadian governments, which long had dreamed of a Pacific cable and talked of it as an "imperial necessity," had been shaken up by the news that a French company, backed by two of the British Australian colonies, had already completed 800 miles of a cable reaching out from Australia toward America. Lord Ripon, Secretary of State for the Colonies, addressed a note of mild remonstrance to the Australian governments, deprecating their dealings with the French, and the Canadian government sent an envoy, the Hon. Mackenzie Bowell, Minister of Trade and Commerce, to Australia to try and persuade the governments there to join with Canada in laying a cable between the Dominion and the Antipodes. Mr. Bowell was accompanied by Mr. Sandford Fleming, a director of the Canadian Pacific Railway Company, which has a line of steamers plying between Canada and Australia, and who himself is the author of several schemes for such a cable. Mr. Fleming is a non-official member of the party, but a mightily interested and active one. So anxious is Canada and the Canadian Pacific Railway to have Australia co-operate in building a cable to land in Canada, and to be under joint control of Canada and Australia, that Mr. Bowell took with him for submission to the Australians a new set of proposals, drawn up by Mr. Fleming, for a trans-Pacific cable, which offers four alternative routes, all having their terminus at Vancouver.

But the success of the Canadian commercial and British imperial designs seem worse than dubious. The French company, already in the field with 800 miles of cable reaching eastward from Queensland to New Caledonia, is already perfecting its arrangements for immediate extension of their line toward America. Mr. Bowell's instructions were to arrange a conference with representatives from all the Australian colonies. At latest accounts, a month ago, he had not been successful in doing this. The Australian colonies are decidedly disunited. Mr. Bowell had to travel to the capital of each and submit his proposals to each Premier. He told them, among other things, that "the marked desire on the part of Canada to extend her trade relations was primarily due to the efforts made by the United States to force Canada into the Union." His commercial proposals to the Australian governments are mainly the old ones submitted to and rejected by the West Indian and South African colonies; they provide for a reciprocal treaty for the interchange of goods between the Dominion and the Australian colonies. His main interest, he said, centered in the proposed Canadian cable. On that matter he laid vital stress, and all the old points of imperial and commercial desirability and necessity were carefully gone over again. But with his visit nearing its end, and a general understanding among the colonies unattained, he at last proposed to the several Australian governments that a conference should be held in Canada about the end of this month to consider the Pacific cable question and the commercial relations of Canada with the Australasian colonies. Disappointment and delay attends even this proposal, for South Australia finds it impossible to send any representative of that colony to Canada before the end of December.

But while the British projects, imperial and colonial, for a Pacific cable are still in the air, and likely to remain there for some time, the French cable will very soon be in the water. Capt. Audley Coote, the representative of the Société Française des Télégraphes Sous-Marin, who was mainly instrumental in securing the laying of the cable from Queensland to the French settlement of New Caledonia, is now on his way to England to complete arrangements for the extension of that cable toward this continent. Before leaving New South Wales he wrote to the Premier of that colony, which is one of the subsidizers of the New Caledonia cable, severely criticising the project submitted by the Hon. Mr. Bowell, and affirming that the route planned by Mr. Sandford Fleming is an old one, now discredited, and that the whole scheme is far inferior to the French company's. It will be impossible, he claims, to lay a Pacific cable which shall not touch other than British territory. Mr. Fleming's plan ignores Honolulu, which would be an important point against its receiving any American support or favor. Capt. Coote attaches no importance to the talk about the danger of misuse of the French cable in time of war, as treaties provide for the protection of such cables. Nor does he think that large guarantees will be required from any government. The Australian colonies may never be asked to pay their guaranteed contribution to the maintenance of the New Caledonia cable, according to the indications from the success already attending its operation.

Orders have been given, Captain Coote says, for the material for the second section of the French cable, from New Caledonia to the Fiji Islands, a distance of 791 miles, and he is now on his way to London to make arrangements for the laying of it. There is no doubt whatever, he says, as to the extension of the cable, with the American Continent as the terminus in view. The French company will continue the project whether the Australian colonies assist or not. It is no new plan of the company's. Captain Coote has been at work on it many years, and has secured valuable privileges, concessions and promises of support from the Fijiian, Samoan and Hawaiian governments. The third section, from Fiji to Samoa, will be 685 miles long, and this Captain Coote expects to see completed within 18 months. The succeeding sections will be from Samoa to Hawaii, *via* Fanning Island, 2,417 miles, and lastly from Hawaii to this continent.

It is in this last stretch that the United States has vital interest, and it would seem that now is the time for that interest to take the shape of practical expression. Hawaii is equally interested, and the matter is being earnestly discussed in the press of that country. The Pacific cable should have its American terminus at San Francisco On this point Americans and Hawaiians are agreed. The French Company's plans are at present made for making Vancouver the terminus of the cable. It expects to receive some support from the British government, both in the building of the Hawaiian-Vancouver section and in the link from Fiji to Samoa. But there is every reason to believe that if it received due encouragement from the government or capitalists in this country it would as lief complete the cable direct from Hawaii to San Francisco. Indeed the Comte de Douville Millefen, who is largely interested in the French cable, has recently said that San Francisco is the natural and best terminus for the cable, and should be selected.

There is every practical financial and commercial reason, apart from political reasons, why the cable should be laid from Hawaii to San Francisco, instead of to Vancouver. The cable from Hawaii to Vancouver would be 2,675 miles long; from Hawaii to San Francisco but 2,247 miles. These figures allow for the necessary slack of the cable. The San Francisco route is, therefore, the shorter by 428 miles. A cable such as would be laid there costs about $1,200 a mile, so that one could be laid from Hawaii to San Francisco at a cost of $510,000 less than from Hawaii to Vancouver. There would also be an important gain in ease and speed of operation in the shorter cable. The surveys made by the steamers "Bangor," "Albatross" and "Thetis," show that the ocean bed between Hawaii and California offers the most favorable conditions ever known for the laying of a cable, conditions far superior to those of the Vancouver route. Lieutenant Clover, who had charge of the surveys made by the "Albatross," reported the most favorable cable route to be a direct line between Monterey Bay, Cal., and Honolulu. "It will require," he said, "a minimum length of cable in passing over an even bottom, consisting of soil which is favorable for its protection and preservation, avoiding submarine mountains and volcanic regions where substances exercising an injurious chemical action on the covering of the cable are likely to exist, and where future convulsions may cause its destruction."

The opportunity presented to this country is a great one. With every reason that the Pacific cable, connecting North America with Australia, China, Japan, and all the further East, should have its terminus on United States soil, there is no reason why that end should not be assured by at once building the last link in the chain—a cable from San Francisco to Honolulu. It would assure American control of the Pacific cable when completed, and it would most probably be a profitable enterprise from the start. "The events that have occurred during the present year demonstrate its necessity," says the Honolulu *Pacific Commercial Advertiser*. "Had the line been in operation since January last the press and government dispatches alone would have yielded a revenue exceeding $100,000 for the current year."

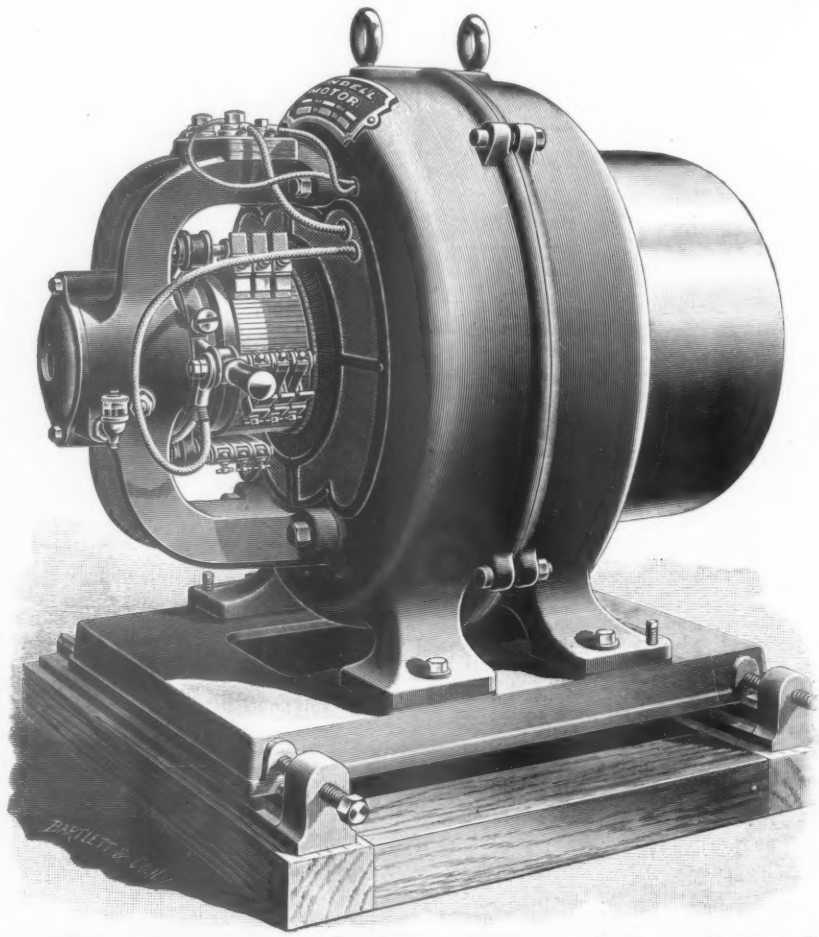


FIG. 1.—LUNDELL DYNAMO, MANUFACTURED BY THE INTERIOR CONDUIT AND INSULATION COMPANY, NEW YORK.

A demonstration was given on Saturday, at the Cardiff Town Hall, to test the utility of search lights in connection with sign writing. Captain Ronald Scott, M.I.E.E., supplied the machinery and conducted the experiments. The current was generated by means of a dynamo worked at the rear of the Town Hall. Taking alternately for a background the highest buildings in the vicinity, trees and steam, by means of slides after the pattern of those used in magic lanterns, local crests, words and faces were thrown upon those objects. Thousands of persons enjoyed this novel spectacle.—*London Electrical Engineer.*

The Lundell Direct Current Dynamos and Motors.

The Lundell type of direct current dynamos and motors is remarkable for simplicity and compactness. In fact, this type is so simple that an elaborate description of the different parts is unnecessary. The chief characteristics are embodied in the novel construction of the field magnet, whereby a single energizing coil magnetizes all the pole pieces, and a strong protecting shell for the windings of both field and armature forms the magnetic circuit.

The arrangement of the field magnet and its energizing coil is clearly illustrated in the illustrations herewith.

It will be noted that the two field magnet halves, when bolted together, form a shell which completely protects the armature, the whole of the shell being utilized in the magnetic circuit. These field magnet halves are so designed that they are readily withdrawn from the mould in casting. The cross section of the shell equals the cross section of the base of the pole pieces, so that no choking of the lines of force can occur at any point. Cast steel is employed for all these dynamos and motors The single energizing coil not only reduces the construction of the machine to the simplest point, but by having only two terminals it is especially adapted to be placed in the hands of inexperienced users, as it avoids any possible mistake in connecting up or any bother or delay in examination when such becomes necessary. Another feature of the design is that the pole pieces are magnetized directly, and the resistance of the magnetic circuit reduced to a minimum, whereby a considerable economy in the ampere turns of the energizing coil is effected.

The armature adopted for these machines is of a modern Pacinotti form. This type of armature has in the past been subject to unfavorable criticism on account of the resultant heating of the pole pieces, but it is now pretty well recognized that this heating was not due to the Pacinotti ring itself, but to the lack of knowledge with regard to its proper design. A little reasoning will show that when the ratio of the distance between the teeth and the magnetic gap is too small, a concentration of the lines of force will take place so that the pole pieces will be swept over alternately by sections of the highly concentrated lines of force, and by practically inert material. The result is that Foucault currents must inevitably be set up in the pole pieces and cause the heating, which has been noted in the past. By so proportioning the teeth, however, that the lines of force emanating from the pole pieces are more evenly distributed over their entire surface surrounding the armature, this abrupt demarcation is avoided, with the result that Foucault currents are also avoided in the pole pieces.

The result of actual practice with the Lundell machine, it is said, has shown the soundness of this theory, which is carried into practice by the employment of deep and narrow slots.

Notwithstanding the iron-clad nature of the machine, the concentric position of the field coil allows the armature to be withdrawn without disturbing either the field coil or the pole pieces.

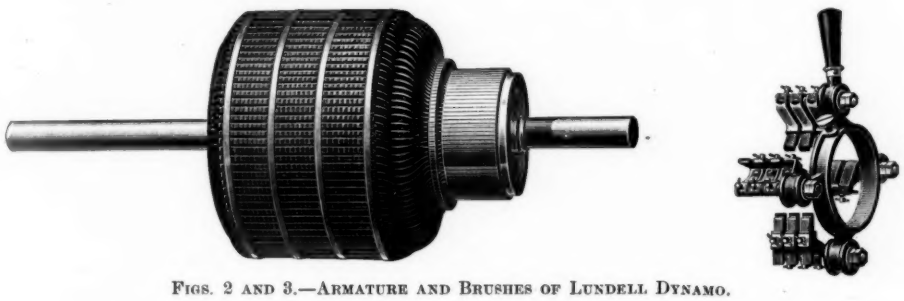
The openings around the armature at the ends of the field magnets are, in the larger machines, covered with metal screens to protect the working parts, and to secure at the same time perfect ventilation. The commutator portion of the armature alone projects outside the screen, and is well protected by a strong bracket which carries the outboard bearing. The brushes are arranged diametrically around the commutator and the opposite brushes are in all four pole machines connected together. They can be raised from the commutator when the machines are not in use.

The brushes of the two pole type have a unique spring arrangement for pressing the carbon brushes against the commutator. The spring has its rear end placed in a curved slot at the end of the brush holder, while its forward end, in the shape of a T, presses against the carbon which slides in the ways in the brush holder. To remove the carbon, it is merely necessary to press the spring upwards out of the slot, which releases it so that the T can be withdrawn, and the carbon slides out.

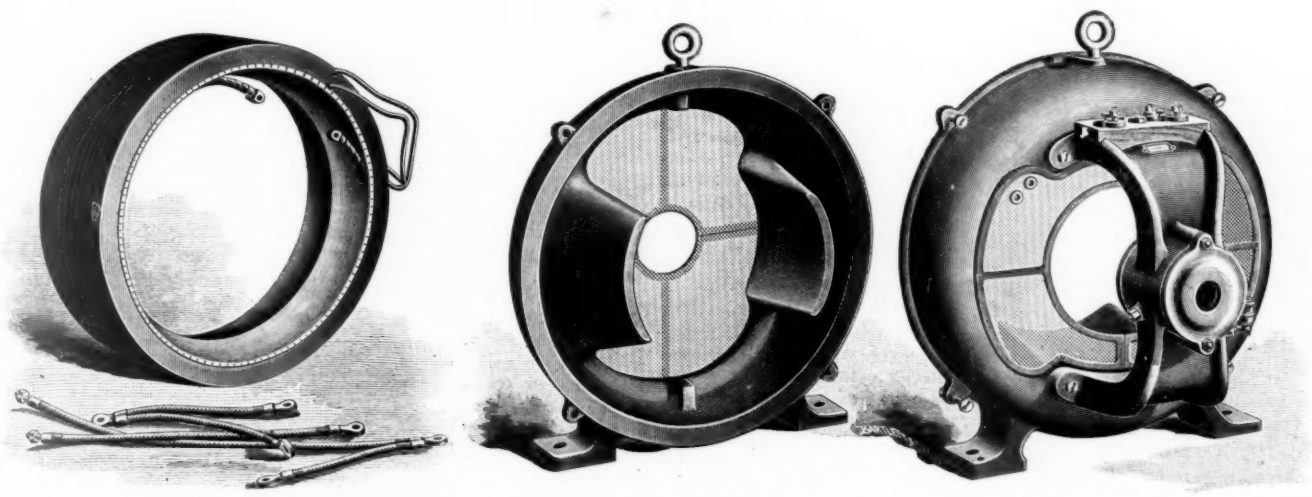
The bearings are constructed with mechanical accuracy, are self-oiling and are provided with a vision gauge. The bushings are made of the best material and are so arranged as to be readily removed and renewed when worn out.

Recognizing also the necessity of continuous lubrication, oiling is accomplished by means of a number of rings which encircle the shaft and dip into the reservoir, thus continually feeding fresh oil to the bearing. In order that the attendant may know the exact condition of the oil, a simple oiling device has been added, consisting of an elbow with an oil chamber, rising slightly above the normal level of the oil. The vertical arm of this elbow is so arranged that when the visual gauge is half filled the bearing is properly oiled. The glass tube is made so short that by no possible inadvertency can the attendant pour in oil sufficient to flood the bearing and cause the oil to run out at the inner surface of the shaft and so go into the armature.

The Interior Conduit and Insulation Company, of New York, guarantee that the efficiency of the Lundell dynamos and motors is as high as can be obtained by any first-class machine.



FIGS. 2 AND 3.—ARMATURE AND BRUSHES OF LUNDELL DYNAMO.



FIGS. 4, 5 AND 6.—MAGNETIZING COIL AND FIELD MAGNET HALVES, LUNDELL DYNAMO, FOUR POLE TYPE.

A Brooklyn Tragedy.

It was wild midnight. The lightning's flash, thunder's roar and dashing rain mingled with the shrill scissors-grinding buzz of the trolley as the electric car dashed madly along. The solitary passenger approached the conductor: "Aren't you afraid of the lightning on these electric cars?" The conductor's eye glittered with a baleful light. "No," he answered, "lightning never strikes a good conductor, you know." The stranger reeled, fell over the railing and was speedily crunched under the car following close behind. "One more," hissed the conductor, as with fiendish glee he bit a fresh nick in the brake handle. "The deadly trolley has numbered another victim."—*Life*.

Recalling Happy Days.

Virtuoso—You appear to be very fond of Wagner's music.

Mr. Newrich—I am, indeed. I began life in a boiler factory, and it reminds me of my youth.—*Truth*.

LITERARY.

McClure's Magazine for January is as attractive in illustration as in reading matter, and what first strikes one in glancing through it is the notable wealth of portraits. One of Parkman, the historian, serves as frontispiece; and in the "Human Documents" department (which, by the way, abates none of its interest and novelty) are others of Parkman, as well as a series of Rider Haggard, the novelist, and a series of the eminent French physician and scientist, Charcot. Then there are portraits also of Jules Verne, the late Professor Tyndall, Professor Huxley, the Duke of Argyll, Samuel Smiles and Prof. Max Müller.

The publishers of *The Forum* announce that the success of the reduction in its price to $3 a year and 25 cents a number has been instantaneous, and both more rapid and very much greater than had been anticipated. Within a month the circulation has increased by leaps and bounds, so that *The Forum* now, it is claimed, has a larger audience than any review has ever hitherto had anywhere in the world. The January number comes with 15 timely discussions, among which are: "The Teaching of Recent Economic Experiences," by David A. Wells, wherein this distinguished economist writes not from a political but educational point of view. He sums up the almost incalculable loss in money and in the confusion of the world's activity by the recent panic and the present dull times. On this remarkable group of facts which he has collected with great industry, Mr. Wells builds an argument to show that our recent and present economic misfortunes are traceable solely to the popular ignorance of economic laws.

A Good Record.

One of the Westinghouse kodak generators at the Fair attained the remarkable record of a continuous run of over three months' duration, according to the *Engineering Record*. The machine is a combined engine and generator with direct coupled shafts. That an engine and generator should both operate for 90 days of 24 hours each without disorder and without stopping is notable, when it is considered that either one is extremely liable to derangement, and especially a direct connected machine. The feat is the more remarkable from the fact that at the close of the run the engine and generator were, to all outward appearances, in as good trim for a continuation of the work as they had been at any previous time. The smoothness of operation of the machine at every point was as remarkable a feature of the performance as the simple fact of the great length of run.

Judge Pratt, in the Supreme Court, Brooklyn, N. Y., has issued a temporary injunction restraining the Kings County and the Nassau Electric Railway Companies from constructing railroads along the routes secured to them by their franchises. The action is brought by John Adamson, and is to test the validity of the franchises.

Self-Induction.

BY J. S., IN LONDON "INDUSTRIES AND IRON."

To investigate the pull of magnets in accordance with the principles explained in our last article, we will take a concrete case and work it out. Suppose we have a magnet with an armature a small distance from the poles. Imagine that there is a coil of 100 turns of wire excited by a current of one ampere, so that there are 100 ampere turns. There will be a certain induction produced in the iron core. If there were no magnetic leakage, or stray field, we could say that the 100 turns of wire embraced so many lines of induction. We cannot, however, say this, because there will be a waste field, and the turns nearest the yoke of the electro-magnet will embrace a larger total field than the turns nearer the poles. We can, however, consider each turn as embracing so much total field, so that we can sum the whole as so many line turns. Thus, if the cross sectional area of the core is one centimetre, and the average induction 10,000, we have an average of 10,000 lines included in each turn, or a million line turns. This is, if we have a current of one ampere. It will be seen that we are here dealing with a question of magntic potential and a resulting flux, and the flux depends on the nature of the magnetic circuit, or on the magnetic reluctance of the circuit. The term magnetic reluctance is, as already explained, vague, on account of the stray field. Apart from questions of stray field, the magnetic reluctance is found by dividing the excitation by the total flux; or by the lines of induction, the excitation being taken in ampere turns, or in C. G. S. units of magnetic potential. The number of turns of wire does not come in.

We have not so far considered self-induction. It is generally denoted by L, and it is such a highly artificial idea that few engineers have very clear notions about it. The term is, in fact, frequently used without any very definite meaning, as when people talk of the self-induction of a transformer, or of a dynamo. In these cases it is always represented by a letter, and not by a number, and very few people have the least idea whether a given coil of wire would have a self-induction of a henry or a micro-henry. Self-induction is also treated as having to do with a sort of electrical inertia.

An electric circuit has unit self-induction when, if the current increases at a rate of an ampere per second, there is a back electro-motive force of one volt. Thus, if the current increases uniformly from zero to one ampere in a second, there is a back pressure of one volt, which means that if there is one turn of exciting wire, 10^8 lines of induction must have cut it in this second. If there are 100 turns of wire there must be 10^6 lines, and so on. A self-induction of a henry may, therefore, be also defined as such, that if there is one ampere the product of the turns by the total induction inclosed by each of them is 10^8. It will thus be seen that magnetic reluctance and self-induction are very closely related. Magnetic reluctance considers the magnetic circuit only, while self-induction considers the number of turns of wire in the coil, too. If the magnetic reluctance is taken as the magnetic potential divided by the total induction, it is the reciprocal of the self-induction where there is only one turn of exciting wire. The self-induction, however, varies as the square of the turns of wire in the exciting coil. For instance, if there are two turns instead of one, one ampere gives two ampere turns, and, therefore, twice as much total induction, and the growing induction cuts twice as many turns. The current, increasing at a given rate, therefore generates four times the counter-pressure. There is thus a simple relation between self-induction and magnetic reluctance. The self-induction is the reciprocal of the magnetic reluctance, multiplied by the square of the turns in the coil.

It is questionable whether there is any use dealing with self-induction at all. It is a term and an idea that is used mostly by purely academical writers when they have not clear numerical notions of the quantities with which they deal. It is highly improbable that we can now get rid of the term or the ideas connected with it; but it shows a confusion of mind in the advocates of the magnetic resistance idea that they should want to have units of magnetic resistance and self-induction, without realizing how they are connected. We ought to have a consistent system. In an electrostatic circuit the ratio of the electric displacement to the pressure is called the capacity. In a magnetic circuit, therefore, what people call the magnetic conductance should be called the magnetic capacity of the circuit, and the idea of self-induction should be shelved with the inertia notions that belong to it. It is, perhaps, hardly necessary to remind the reader that as the permeability of iron varies with the induction, the magnetic capacity, as well as the self-induction, in a case where there is iron, varies with the induction also.

It may be said that we can never get rid of L, it is so useful, for instance, in calculations in alternating current work. To this it may be replied that in nine cases out of ten writers who use L have not the least notion of its numerical value. Examine any of the numerous clock-face diagrams in treatises on hypothetical transformers, and scale the lines, and they will be found to be ludicrously out of proportion. On the other hand, what has here been called the magnetic capacity comes into equations equally conveniently. In the case of a condenser and alternating current, the virtual or effective current is $2\pi nvk$, where n is the frequency and v the pressure, and k the capacity. In the case of a magnetic circuit, what we have to consider to make the case quite analogous is the alternating magnetic current. This is a similar expression where v is replaced by the excitation and k by the magnetic capacity. The expression is not wanted, as a rule, in this form. The electric current can be discussed, however, by writing the usual equations, but replacing L by the magnetic capacity and the square of the turns. In working with coils, for example, this is much better. K then depends on the shape and size of the coil, or the form and disposition of the iron in an electro-magnet, and t^2 on the number of turns, which is really a mere winding detail to most engineers. If Kt^2 were always used instead of L, we should see less vagueness about self-induction. Probably few electrical engineers realize that there is a very simple connection between the pull of a magnet and its self-induction. We have, therefore, inserted this apparent digression about self-induction in the middle of the discussion of the pull of magnets.

The Adams Electric Company.

Mr. A. D. Adams resigned his position as electrician and manager of the Commercial Electric Company, of Indianapolis, December 1, and has formed, with others, the Adams Electric Company, for the manufacture of his improved dynamos and motors, at Worcester, Mass. Mr. Adams' new machines will be of the same general type as his former ones, will embody his well-known forged iron field magnet construction, and several important improvements.

Realizing that most armature burn-outs are due to the destructive action of heat on the cloth and paper usually employed to insulate armature cores from their windings, Mr. Adams will use a fire-proof material for the insulation of all armature cores in his new machines. The line of dynamos and motors at present manufactured will cover the usual sizes from 1 to 25 kilowatts.

A large well-lighted shop is being fitted up at 100 Beacon street, Worcester, for the manufacture of the above machines, and shipment of any of the sizes named can be made during January. The encouraging fact is reported that orders for several machines have already been received.

The Difference.

Why are barbers and linemen alike? Because they work around "polls."

Rewards for Meritorious Discoveries and Inventions.

The attention of ingenious men and women is hereby directed to the fact that the Franklin Institute, of the State of Pennsylvania, for the promotion of the mechanic arts, may grant, or recommend the grant of, certain medals for meritorious discoveries and inventions which contribute to the promotion of the arts and manufactures.

The character and conditions of these awards are briefly stated in the following:

The Elliott Cresson Medal, founded in 1848 by the gift of the late Elliott Cresson. This medal is of gold, and by the terms of the deed of trust may be granted for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process, or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The John Scott Legacy Premium and Medal ($20 and a medal of bronze), awarded by the city of Philadelphia. This medal was founded in 1816 by John Scott, a merchant of Edinburgh, Scotland, who bequeathed to the city of Philadelphia a considerable sum of money, the interest of which should be devoted to rewarding ingenious men and women who make useful inventions. The premium is not to exceed $20, and the medal is to be of copper, and inscribed "To the most deserving."

The control of the Scott Legacy Premium and Medal (by act of the ordinance of councils in 1869) passed to the Board of Directors of City Trusts, and has been referred by the board to its Committee on Minor Trusts, and that committee has resolved that it will receive favorably the name of any person whom the Franklin Institute may from time report to the Committee on Minor Trusts as worthy to receive the Scott Legacy Premium and Medal.

The Edward Longstreth Medal of Merit, founded in 1889, by Edward Longstreth, machinist, and late member of the Baldwin Locomotive Works. This medal is of silver, and may be awarded for useful invention, important discovery and meritorious work in, or contributions to, science or the industrial arts.

Full directions as to the manner and form in which applications for the investigation of inventions and discoveries should properly be made will be sent to interested parties on application to

WILLIAM H. WAHL,
Secretary Franklin Institute,
Philadelphia, Pa., U. S. A.

New Electrical Wonders At Hand.

In the nearer foreground I see a practical method for the production of electricity directly from the burning of coal. This achieved, there necessarily follows the universal adoption of the electric motor as a prime mover; the relegation of the steam engine to the scrap-heap; and the almost immediate realization of the air-ship as a means of transportation.

Assuming the cause of chemical affinity to lie in the unlike electric charges of the combining atoms, I see the practical realization of electric synthesis, whereby wholesome food products will be directly formed under the potency of electric affinities. I see, too, a marked advance in electro-therapeutics, whereby human life will be prolonged and its sufferings alleviated. Diagnosis and prognosis will be profoundly aided by exact electrical measurements of the various organs of the human body as regards their electro-motive force and resistance. The electro-therapist of the future will employ electric charges and currents for restoring the normal charges and currents of the body, as well as for the stimulation of nervous or muscular tissues.

Back of these achievements I discern a practical apparatus for seeing through a wire; *i. e.*, a device for looking into a receiver at one end of a metallic wire and seeing therein a faithful reproduction of whatever optical images are impressed on a transmitter at the other end, even through thousands of miles intervene. I see the possible use of the step-down transformer for the preparation of a road bed or road surface by the vitrification, *in situ*, of clay or other suitable soil, by the intense heating power of enormous currents of electricity.—*Professor Edwin J. Houston, in McClure's Magazine.*

Northwestern Electrical Association.

A special effort has been made to make the January meeting of the Northwestern Electrical Association the most interesting of any yet held. The papers will be instructive, and no one in the electric business in the Northwest can afford to be absent. The previous meetings have been productive of much good, and have fully demonstrated the value of the association.

The meeting will be held at the Hotel Pfister, Milwaukee, Wis., January 17 and 18, 1894, commencing at 2 o'clock P. M. The management of this hotel has made a special rate for this occasion. Warm rooms and courteous treatment have been assured.

The programme of the meeting is announced as follows:

WEDNESDAY, 2 P. M.

ORGANIZATION AND PRESIDENT'S ADDRESS.

"New Things in Electricity," W. W. Low, President Electric Appliance Company, Chicago.

WEDNESDAY EVENING.

"Essential Station Instruments," Professor Jackson, Madison.

"Economical Use of Transformers," Forman Collins, vice-president *Western Electrician*, Chicago; J. McFadden, of the General Electric Company, Chicago.

THURSDAY A. M.

"Corliss Compound Engines," E. L. Debell, Sheboygan.

"Advantages of Direct Connection," W. N. Stewart, Siemens & Halske Electric Company, Chicago.

THURSDAY P. M.

"How Shall Members Buy Supplies?" H. C. Thom, Madison.

"Supply of Electrical Power from Central Stations."

THURSDAY EVENING.

Pleasure.

Towing By Electricity.

The adaptation of electrical energy in any new direction deserves attention, and when we consider the decadence of canal traffic upon our English canals anything which promises to assist in resuscitating their activity will be welcomed. In America and France experimental trials have been made in regard to electric towing. France claims precedence in this new departure, both as regards point of time and extent of experiment. Here upon the Bourgogne Canal, nearly four miles long, with more than half the length in tunnel, for the past two months electric has successfully replaced horse towage. There are two stations wherein Gramme machines are driven by water power, one at each end of the canal. The Gramme machines are put in series, and parallel line wires arranged so that the motor placed between takes off from one wire, making the return through the other. The motor drives by two sets of gearing—one for light and the other for heavy load. With a light load the distance was run in about 45 minutes, using a current of about 12 amperes; with a heavy load of 17 boats, carrying 1,500 tons, it took two hours, using a current of 20 amperes. The normal speed of the motor is 1,000 revolutions per minute. Accumulators are used as regulators. In many cases, as at the Bourgogne Canal, the prime motor power may cost nothing, but even then the cost of an installation and maintenance will be considerable. English canals are comparatively little used. Some people contend that this is the result of railway competition and ownership; others assure us that it is the result of the product, time and cost. At any rate, those interested in the matter ought to consider how far electricity will help them to a renewal of activity.—*London Electrical Engineer.*

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

Electric Light and Power.

SAN MARCOS, TEX.—The San Marcos Electric Light and Power Company, San Marcos, will increase their capital to $20,000, and make some improvements in their plant.

GEORGETOWN, TEX.—The Georgetown Waterworks and Electric Light Company; capital, $100,000.

MILWAUKEE, WIS.—The Milwaukee Arc Light Company has filed articles of incorporation with the Secretary of State. The capital is $100,000. Incorporators: Gottlieb Wenninger, Henry A. Adler and Bernard Conrad.

MADISON, WIS.—The Soldiers' Grove Electric Company filed articles of incorporation in the office of the Secretary of State recently, with a capital of $1,500. Ex-Railroad Commissioner Atley Peterson, James Klingsberg, George C. Baker and 13 others are the incorporators.

MADERA, CAL.—The Madera Electric Company has incorporated, to establish electric, gas and water works, with $100,000 capital and $2,500 subscribed. Directors, F. W. Krogh, Charles A. Krogh, Charles G. Buckland, Sol. Cezar and H. K. Olsen.

STROMSBURG, NEB.—Articles of incorporation will be filed very soon by the Stephenson Electric Light Company, with J. B. and P. T. Buckley, J. A. Frawley, G. S. Osborne and Dr. W. A. Post as the incorporators. The capital stock is placed at $25,000. The inventor and patentee is Mr. C. F. Stephenson, of this city. The company comprises some of the most successful business men here.

CHICAGO, ILL.—Wallace Electric Company, capital, $2,000. Incorporators, William J. Candlish, William V. R. Lansigh and Jessie F. Pebbles.

New Electric Railways.

JACKSONVILLE, FLA.—It is reported that the Bay Street Railway Company will be equipped with electricity.

CARLISLE, PA.—A charter has been granted to the Cumberland Valley Traction Company with a capital of $1,000.

New Manufacturing Companies.

ST. PAUL, MINN.—The Mechanics' General Manufacturing Company, of this city, with capital stock placed at $10,000,000, has filed articles of incorporation with the Secretary of State. The object of the corporation is to manufacture electric motors, aluminum wares and the Dent telegraph typewriter when perfected. The officers and incorporators are D. H. Kent, St. Paul Park, president; A. A. Price, vice-president; F. M. Johnson, secretary; P. L. Utley, treasurer, and C. J. Backus, all of this city, except Mr. Kent.

KANSAS CITY, MO.—Articles of incorporation were filed last week by the Electric Cash Carrier and Change Maker. It has a capital stock of $100,000 made up of 1,000 shares at $100 each. George P. Gross owns 180, Mark Coppinger 360, Charles A. Gaiser 180, Charles A. McKiernan 100, and Edwin R. Gill 180, shares. The company is organized to manufacture and sell an electric change making apparatus.

CHICAGO, ILL.—Cutler-Hammer Manufacturing Company, to manufacture electrical appliances; capital, $10,000. Incorporators, H. H. Cutler, E. W. Hammer, R. L. Commons.

New Telephone Companies.

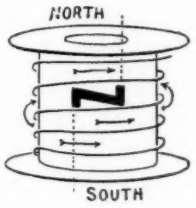
NASHVILLE, TENN.—The Drawbaugh Telephone and Telegraph Company has been chartered. The purpose of the company is to operate telephone and telegraph lines in Pennsylvania and other States, and its object in coming to Tennessee is to take advantage of the incorporation laws. The company claims a capital of $2,000,000.

MILWAUKEE, WIS. — The Northwestern Telephone and Electric Company has filed articles of association in the Secretary of State's office; the capital is $50,000. Incorporators, A. B. Ferdinand, H. C. Dodge and Edward W. Spencer.

To Determine the Polarity of Electro-Magnets.

TO THE EDITOR OF ELECTRICAL REVIEW:

Of the many rules given in the text books how to determine which is the north end of an electro-magnet, I have seen none which possesses any distinctive feature such as will make it adhere firmly to the memory. The following rule which was suggested to me by the last letter of my name, and which I call my Z rule, I think will be found very handy by your readers, as it is very easy to remember. From our system of geography



it comes natural to everybody to look upon the upper or top portion of things as north, and the bottom or lower portion as south. Imagine, then, the line which connects the parallel lines of a letter Z to be a little more perpendicular than it is usually written. Now, taking this letter and applying it to an electro-magnet so that the connecting line of the Z shall lie in the same direction as the coil is wound, looking in the direction in which the current is flowing. The upper or northern portion will point to the north pole and the lower or southern portion will point to the south pole. Yours truly,

M. A. LOPEZ.

New York, December 15.

ELECTRIC RAILWAY AND POWER NOTES.

The proposed electric railroad between Watkins and Havana Glens, N. Y., is again being agitated.

J. N. Cropper gave bond in $20,000, on December 20, and was appointed receiver of the Muncie Electrical Works, of Muncie, Ind.

The Washington, Pa., Electric Street Railroad, which has been in the hands of a receiver, has suspended operations and will be sold by order of court.

Edward C. Hinman, of Battle Creek, Mich., has been appointed receiver of the Battle Creek Electric Railway Company, and his bond has been filed at $15,000.

The power house of the Logan Valley Electric Railway, at Altoona, Pa., eleven cars and valuable machinery, were damaged by fire last week. The loss is $25,000.

The huge fly-wheel in the power-house of the Des Moines, Ia., Electric Railway exploded on December 23, wrecking the roof of the building and inflicting damages amounting to $10,000. Nobody was injured.

PERSONAL.

Mr. W. C. Bryant, of the Bryant Electric Company, Bridgeport, Conn., was in New York last week.

Col. T. C. Boone, one of the founders of the Buckeye Engine Company, died at Salem, O., on December 20, aged 72.

Col. Gardiner C. Sims, of the Armington & Sims Engine Company, Providence, R. I., is rapidly recovering from an attack of the grip.

Mr. H. L. Shippy, manager of the New York office of the John A. Roebling's Sons' Company, has returned to New York after a trip to Europe.

Mr. S. A. Douglas, until recently Western manager for the Brush Electric Company, at Chicago, has been appointed general sales agent for the General Incandescent Arc Light Company, of New York.

Capt. W. L. Candee, managing director of the International Okonite Company, Limited, 13 Park Row, New York, returned from a business trip to England in time to celebrate Christmas at his home in Brooklyn, N. Y.

Superintendent F. Wayland Brown, of the Youngstown, O., Electric Street Railway, whose retirement took place on January 1, has accepted a position as manager of an electric street railway, electric light and heating plant, at Ottumwa, Iowa.

Mr. A. M. Young, president of the New England Engineering Company, of Waterbury, Conn., and who is largely interested in electric lighting and street railway properties throughout New England, was a welcome visitor to the ELECTRICAL REVIEW office last week.

At Chicago, on December 22, Miss Florence Louise Root was married to Mr. Horatio Alvah Foster, the well-known New York electrical engineer, now connected with Prof. George Forbes. The ELECTRICAL REVIEW extends hearty congratulations to Mr. and Mrs. Foster.

Mr. William J. Hammer, the well-known electrical engineer, of New York city, has decided to forsake his bachelor friends. On January 3, 1894, he and Miss Alice Maud White, of Cleveland, O., will be married at he home of the bride on Euclid avenue. The ELECTRICAL REVIEW congratulates Mr. Hammer, whose New Year will surely be a happy one.

Mr. John J. Nate, for several years past the purchasing agent of the Chicago Telephone Company, severs that connection with the beginning of the new year, and assumes the management of the Metropolitan Electric Company. Mr. Nate is an energetic and progressive gentleman, and has many friends who will wish him not only a Happy New Year, but a prosperous one as well.

Mr. E. L. Babcock, of the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio, was in New York last week, and was the victim of a very unpleasant experience. As Mr. Babcock was crossing the corner of Church and Dey streets a careless truck driver ran him down. He sustained injuries which necessitated his removal to the New York Hospital, but was able to leave for his home the next afternoon. The ELECTRICAL REVIEW joins Mr. Babcock's many friends in congratulating him on his lucky escape from what might have been a very serious accident.

Mr. F. R. Chinnock, who for the past two years has been the general Eastern agent of the Ball Engine Company, of Erie, Pa., has resigned his agency of that company and will again enter the electrical field, with which industry he was so long and successfully identified. While Mr. Chinnock has been very successful as the agent of the above company, he feels that he will be still more successful in the larger and broader field of electricity, in which line he met with much success as the agent of the Edison General Electric Company, with whom his many friends will remember he was associated for eight years. Mr. H. C. Duval will still be connected with the New York office of the Ball Engine Company.

American Institute of Electrical Engineers.

At the monthly meeting of Council, held December 20, the following associate members were elected:

E. L. Etheridge, Inspector Electrical Engineering Department, World's Columbian Exposition, 66 North Oxford street, Brooklyn, N. Y.

Charles T. Lindner, Inspector Electrical Engineering Department, World's Columbian Exposition, Tacoma, Wash.

Frank A. Williams, Safety Insulated Wire and Cable Company, 25 Washington avenue, Newark, N. J.

D. McFarlan Moore, Electrical Engineer General Electric Company, 44 Broad street, New York city.

Arthur Newhall Mansfield, Assistant Electrician American Telephone and Telegraph Company, 153 Cedar street, New York city.

Charles L. Sturtevant, Patent Attorney, Atlantic Building, Washington, D. C.

William L. Puffer, Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology, Boston, Mass.

Louis K. Comstock, Contracting and Consulting Engineer, Monadnock Building, Chicago, Ill.

Herbert S. Mustin, Assistant Electrician City of Hoboken, police headquarters, Hoboken, N. J.

The following associate members were transferred to full membership:

Chas. H. Warner, Consulting Electrical Engineer, 50 Broadway, New York city.

W. A. McClurg, Manager Electrical Department, Plainfield Gas and Electric Light Company, 25 Madison avenue, Plainfield, N. J.

Oliver R. Roberson, Electrician Western Union Telegraph Company, 195 Broadway, P. O. Box 856, New York city.

Leonard C. Wason, Head Draughtsman with F. S. Pearson, 199 Harvard street, Brookline, Mass.

Dr. Johann Sahulka, Docent of Electrotechnics, Technische Hochschule, Vienna, Austria.

W. Le Conte Stevens, Professor of Physics, Rensselaer Polytechnic Institute, Troy, N. Y.

Daniel W. Shea, Assistant Professor of Electrical Engineering and Physics, University of Illinois, Champaign, Ill.

C. R. McKay, Consulting Engineer, 140 South Main street, Salt Lake City, Utah.

Mario Capuccio, Electrical Engineer, Piazza Statuto 15, Corino, Italy.

John E. Hudson, President the American Bell Telephone Company, 125 Milk street, Boston, Mass.

Henry Judson Sage, Electrical Engineer, Telephone Department Western Electric Company, 227 South Clinton street, Chicago, Illinois.

Francis R. Frost, Assistant in Electrical Testing, Bureau of Awards, World's Fair, Ithaca, N. Y.

A. A. Serva, Assistant, Bureau of Awards, World's Fair, North Industry, Ohio.

A. Marcel Requier, Electrical Engineer, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

Charles L. Jaeger, Inventor, Maywood, N. J.

James W. McCrosky, Graduate Student, Johns Hopkins University, 1104 McCulloh street, Baltimore, Md.

Fred. B. Corey, Electrical Engineer, A. B. See Manufacturing Company, 442 Henry street, Brooklyn, N. Y.

Elbert F. Norton, Inspector, City Electrical Inspection, 15 City Hall, Chicago, Ill.

The following associate members were transferred to full membership:

John L. Hall, Manager, Western Union Telegraph Company, 300 Market street, Wilmington, Del.

Elmer G. Willyoung, Electrician, Queen & Company, Philadelphia, Pa.

Augustine R. Everest, Electrical Engineer, Thomson Electric Welding Company, Lynn, Mass.

Richard H. Pierce, Electrical Engineer, World's Fair, Chicago, Ill.

Harry E. Hayes, Assistant Electrician, American Telephone and Telegraph Company, 153 Cedar street, New York city.

No Strike in Brooklyn.

It is said that the men employed on the trolley lines of the Brooklyn City Railroad Company have practically decided not to sign a new contract with the company. They asked an increase in pay from $2 to $2.25 a day, that no man should be discharged except for cause, and that they should have more time for their meals. The company refused all these demands. The men, it is said, will not strike for the present at least. Their policy is to let the present arrangements with the company continue without a formal contract, and later on to renew the demand for more wages.

KINDRED INTERESTS

James I. Ayer & Company, consulting electrical and mechanical engineers, have taken offices in the Security Building, St. Louis.

The Underwood Manufacturing Company, of Tolland, Conn., have one of the most popular dynamo belts made. It is highly complimented by users generally.

The Buffalo Steam Pump Company, of North Tonawanda, N. Y., have sent out a very interesting catalogue for 1894, describing their well-known pumping machinery for all services.

The Bishop Gutta-Percha Company, of New York, are increasing their factory facilities, the demand for their product compelling this increase. The addition will be 25 by 38 feet, four stories high, and will give much additional room. In these contracted times such evidence of prosperity entitles General Manager Henry A. Reed to the congratulations of all.

Messrs. Cushing & Morse, of Chicago, the well-known agents of Kerite wires and cables, remembered the ELECTRICAL REVIEW office with a very palatable Christmas favor. It consists of a neat little box in which repose, in compartments, a remarkably good cigar and a miniature flask of "Old Coronet." The editor took the cigar and the prohibition editor captured the flask, claiming that he is subject to rheumatism in Winter and that "Old Coronet" is a sure cure.

The "Mac Tape" has superior insulating qualities, is guaranteed to withstand the severest climatic changes, is not affected by acids, and claims qualities that no other tape in the market has. It sticks to the wire and not the hands, and will not oxidize the wire. Its adhesive qualities are such that it is practically indestructible, and, hence, will not deteriorate with age. For armature and field magnet wrapping, it is as good as the best. It is sold by the Metropolitan Electric Company, Chicago.

Working full time and full capacity and behind on their deliveries is the gratifying report furnished by the Clayton Air Compressor Works, of 43 Dey street, New York, as to their shops in Brooklyn. In the prevailing business depression this speaks volumes for the excellence of the air compressors built by this company. They have recently taken out several valuable patents on a new triple compound high pressure air or gas compressor, used largely by manufacturers of carbonic acid gas.

The Complete Electric Construction Company, of 121 Liberty street, New York, enter the new year with a number of attractive contracts. General Manager John A. Seely is one of the most active men in the electrical field, thoroughly understands electrical construction of all kinds, and is just now making a specialty of street railway building. The offer of this company to dispose of a number of electric cars, announced elsewhere, is an opportunity for street railway men to secure a bargain.

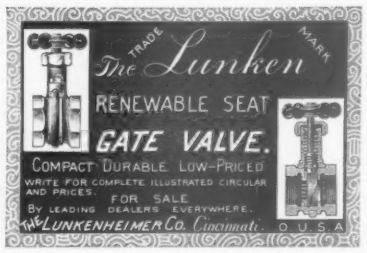
Queen & Company, Philadelphia, have a very excellent portable tachometer, by means of which the speed of engines, dynamos and motors can be quickly and accurately determined. It is compact, convenient to handle and will indicate revolutions up to 3,000 turns per minute. They also have stationary types for permanent attachment. In the economical operation of a lighting or power plant it is highly necessary to run a dynamo very close to schedule speed, which can only be determined by an instrument such as the above.

"A Satisfied Customer is the Best Endorsement."

Mr. Jarvis B. Edson, of New York, N.Y., the patentee of the world-renowned Edson pressure-recording and alarm gauges, for recording steam, water, oil, gas, natural gas, ammonia and pipe-line pressure, which have been in constant use all over the globe for about 25 years, reports that many of the orders he has received this month are from patrons who have had their Edson pressure-recorder several years, and who, in putting in new steam plants, order an additional recorder therefor. This was the case with the Wilkesbarre, Pa., Heat, Light and Motor Company, Providence Gas Company, etc. Truly, a satisfied customer is the very best endorsement. This valuable instrument (giving a record of the pressure carried for the 24 hours, and sounding an electric alarm, either on the instrument or at a distant point, when the pressure falls below or goes above prescribed limits), of which there are many thousands in constant use, is an absolute check upon steam boilers and the boiler house employés, and where it is employed there can be no excuse for "accidents"; because, by the use of this recorder, danger can never approach unannounced. "It is one of the essentials that often saves enough to pay the dividend."

What the Slot in the Screw Heads is For.

Wood screws are made with slotted heads in order that they may be turned into the work with a screwdriver. If you are a journeyman, don't get into the habit of driving screws nearly or part way home with a hammer. If you are a foreman, don't permit such work. It don't hold, and some poor chap may also lose his life just because that screw was not turned in with a screwdriver. The other day I saw a man screwing on grab irons. He drove the screws nearly home, gave each one turn with a screwdriver, and passed to the next. I asked him if he knew what that (pointing to the slot) was for. "Yes," he replied, "it's to put a screwdriver in when the 'old man' is around and you don't care to drive the screw in!" Just then his staging, one end of which was held up by a grab iron on another car, gave way, and this man barked his nose and scraped his shins as he tumbled to the ground. Upon looking around he found that the iron had come off, having been screwed on with lag screws, put in pretty much as he was putting in wood screws. It was a sharp object lesson, and a good one. Don't do so in your shop.—*Railroad Car Builder.*



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